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MACHINERY

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MACHINERY

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CONTENTS OF THIS NUMBER

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The Editor's Monthly Talk

IN modern technical journalism, especially as exemplified in MACHINERY, the Advertising Department is notably succeeding in giving essential editorial character and value to the advertising pages. An examination of MACHINERY shows that mechanical advertising today is compiled, prepared and written in an entirely different manner from that of ten or fifteen years ago. It is prepared, not by advertising specialists alone, but by advertising specialists working in conjunction with engineering specialists, both contributing the essentials necessary for a finished display advertisement giving real information to the reader.

Therefore, instead of talking about the editorial pages today, let us scan those advertising pages in MACHINERY that are prepared in cooperation with the engineering service. These advertisements contain a storehouse of vital information, photographs of machines at work, drawings of the work to be performed, production figures and other valuable data pertaining to the job, not as it might be, but as it is. This information is obtained, not alone in the works of the manufacturer of the machine advertised, but mainly in the shops of his customers, where his machines or other equipment are in actual use. The men who gather these data are members of MACHINERY'S staff. They are themselves practical machine shop men—they know a good job when they see it. Utilizing their shop knowledge, it is possible for them to gather and present technical facts instead of mere claims and opinions. That marks a distinct and important advance in advertising methods. It makes advertising authentic, matter-of-fact, readable, and of actual technical value, not only to the buyer who wants to know, but also to the technical reader who appreciates information on the latest shop practice. It is work essentially educational in character and value.

The Field Service Men and their Work

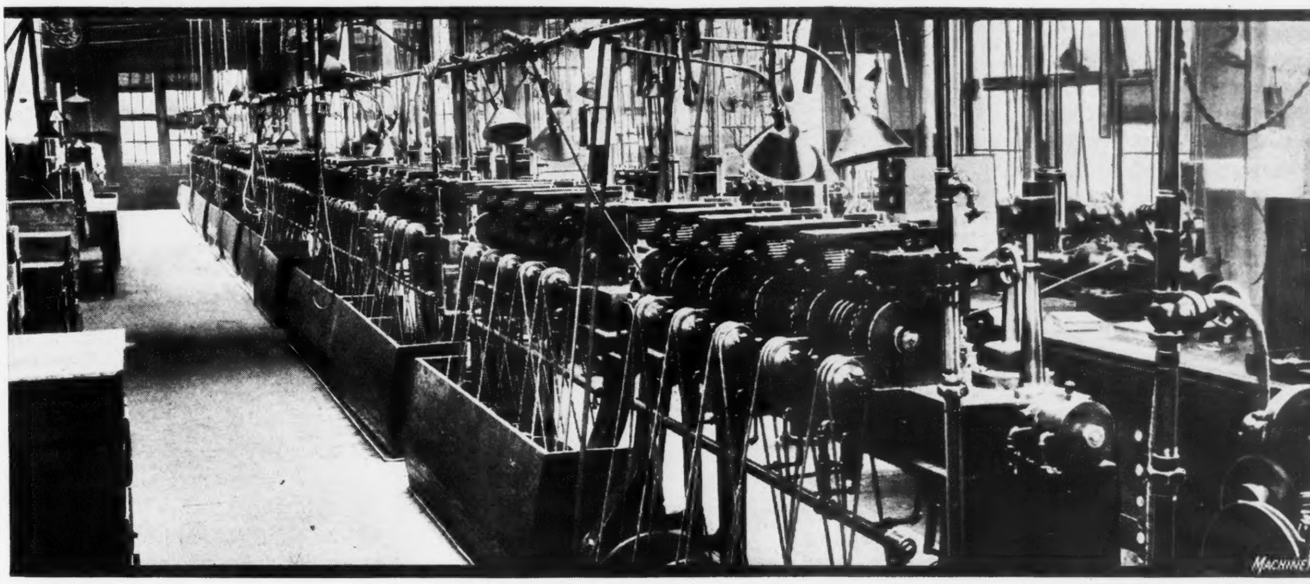
In past talks with MACHINERY'S readers we have spoken of the extensive travels of the editors who cover thousands of miles seeking information in shops everywhere throughout the country where mechanical work of unusual interest is to be found. Today let us say something about the qualifications of the Field Service men and the work they do to lay the foundations of those advertising pages that contain what we are pleased to regard as essentially editorial data.

Before a man is found who is qualified for this specialized work, it is necessary to interview scores of experienced mechanics. Even then only a few of those carefully selected prove fitted for the duties required. These men must have technical training, shop experience, sound judgment and good common sense. They gain broad experience in their work as they regularly visit hundreds of factories in various parts of the country in quest of facts to be presented in MACHINERY'S advertising pages. They come into personal contact with the men in charge of the country's production; they rub shoulders with the producers themselves—the workers; and few men are in a position to learn so much about the practical efficiency of all the different types of machine tools built. The first-hand knowledge thus acquired, fused with their qualifications as advertising advisors, and supplemented by photographs illustrating the job selected, furnishes the sure and definite basis upon which the specialists in the home office design and construct the advertisements which are submitted for the advertiser's approval. The result is advertising essentially instructive, authentic and technical, fundamentally of the same character as the material published in the reading pages of the periodical.

A Journey through the Advertising Pages

A comprehensive review of modern machine tools, devices and shop methods is thus made available in every number of MACHINERY, furnishing reliable information on production to those interested in the mechanical as well as the commercial side of the metal-working industries. The value of such material, compared with the old-time dry, hackneyed phrases, boasts and claims which characterized the advertising of other days needs no elaboration. A multitude of mechanical subjects, such as grinding practice, gear-cutting, production milling, drilling, planing, boring, forging and die-casting, are repeatedly dealt with in this instructive way by the cooperative efforts of the Service Department and the Advertising Department. The information presented is complete and comprehensive, like a concise editorial description of a job, with the added attractiveness of a make-up not always possible in the editorial pages.

This method of presenting the possibilities of a machine or method is not only of great interest to the reader, but carries a forceful argument to the buyer of mechanical products. It brings him a definite message, one likely to leave an impression. Advertisements of this kind start people thinking, talking and acting. The mechanical reader who is not directly a buyer and who gets MACHINERY mainly for the mechanical information it brings him, misses some of the most useful information on production methods that it contains, if he does not faithfully examine the advertising as well as the editorial section. It will be interesting to watch the development of this trend in advertising. It should grow in every field. It extends and amplifies the editorial work, and greatly increases the educational value of technical journalism.



Automatic Machines in a Watch Factory

Machines, Devices, and Methods Employed in the Plant of the Waltham Watch Co., Waltham, Mass.—First of a Series of Articles

By FRED R. DANIELS

THERE is probably no class of machinery in which the compressed air is used for actuating automatic movements more generally than in the equipment of the factory of the Waltham Watch Co., Waltham, Mass. Synchronized movements of operative parts are thus made possible which otherwise would require very complicated mechanism. In many cases the air is applied directly to the moving parts, while in others it is the prime mover, but is used in connection with springs, cams, and ratchets. The abrupt reversal or stoppage of rotation is often a necessary condition in the machines used. This is made possible in many instances by the installation of an air-operated countershaft, such as shown in Fig. 2. The air is admitted through the pipes *A* to an axial hole in the ends of the shaft the construction being the same at each end. The axial holes are connected by suitable air passages extending through the flanges *B*, and the air is applied directly to the adjacent face of each pulley. Between the two pulleys there is a thrust collar *C* fastened by a setscrew to the shaft, so that as the air is applied to the face of either pulley, the frictions which are interposed between the pulleys and the driving collar will rotate the shaft in a direction depending upon the belting of the pulley to which the air is applied. The design of the flanges *B* is such as to form an air-tight pocket between them and the adjacent face of each pulley. By the application of this type of countershaft to the various automatic watch-making machines, it is possible, with proper control valves, to secure the desired reversal of rotation or the abrupt stoppage of the operating members that is often necessary in this class of machines.

The series describing automatic machines employed in the manufacture of Waltham watches, of which this is the first article, deals with the application of mechanical principles to machines embodying an unusual degree of ingenuity, precision, and efficiency. This is the first time in the existence of the Waltham Watch Co. that anything has been published describing the operation of the company's automatic machinery. These machines represent a type in which compressed air has been applied for obtaining automatic movements to a greater extent probably than in any other machines. The late Duane H. Church, for many years in charge of machine design at the Waltham factories, and one of the world's greatest inventors of automatic watch-making machines, was mainly responsible for the development of the various machines here described.

In connection with the description of the machines which follow, it may be well to refer first to the view of an open watch, Fig. 1, showing the plates which are used in its construction to form the supporting structure. Briefly, these are as follows: The pillar plate *A*, which is adjacent to the dial face of the watch and which is recessed for the reception of a number of wheels, and the barrel bridge *B*, balance cock *C*, and train bridge *D*, the three latter being classified as top plates. Between these top plates and the pillar plate is inserted the mechanism of the watch. The balance cock, as the name implies, contains the upper bearing for the balance wheel pivot and has a dome

turned at its outer end on which the regulating finger is assembled. The train bridge contains the bushings or jewels for the upper pivots of the wheels which make up the wheel train. The barrel bridge is recessed for the winding wheels or gears.

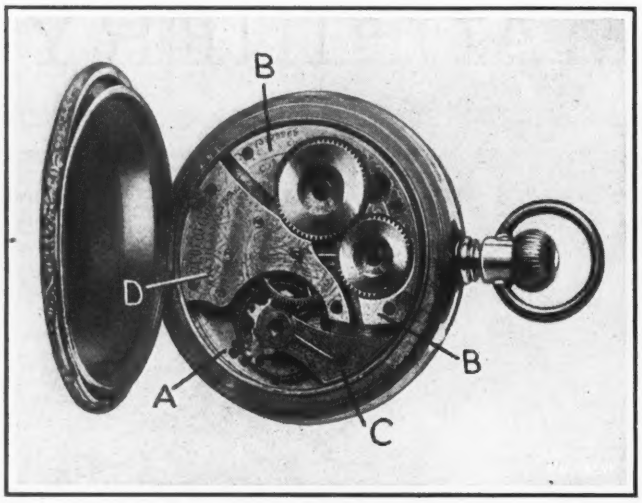


Fig. 1. Supporting Plates in a Waltham Watch

Plate Roughing Machine

The machine used to surface the barrel bridges, pillar plates, and train bridges is illustrated in Fig. 3, and contains three work-spindles, a tubular feed magazine at one end, and a delivery magazine of similar construction at the opposite end. The work is picked up by spring clips *A* and delivered by means of the carrier arms *B* from the feed magazine to the first spindle of the machine; simultaneously with this movement the other carrier arms are delivering the partly finished plates to the next spindle, and the last carrier arm is passing the finished plate from the spindle *C* to the delivery magazine, as shown at *D*. These carrier arms all operate in unison from a shaft located within the machine and operated longitudinally by an air cylinder at the farther end of the machine frame. The shaft has rack teeth cut in it at intervals, and as the shaft is moved back and forth, the arms swing in unison, each on a vertical shaft which carries a pinion at its lower end, engaged by the rack teeth on the shaft. The tool-slides *E* are fed longitudinally and simultaneously by a cam on the opposite end of the machine, as the tools are fed across the face of the work at each station. The slides are returned to their starting position by springs.

The tubular feed magazine at the farther end, is similar in appearance to the delivery magazine *F*, and is connected at the rear with an air line, which advances the work to the front of the tube. It is prevented from pushing the work out, however, by spring jaws such as at *K*. When the work is to be picked up by the clip on the first carrier arm, these spring jaws are forced radially outward and the air advances the first piece of work into the clip where it is seated properly by being forced against a spring plunger which is advanced into a position similar to that shown at *G* at the delivery end of the machine. At the same time that this is occurring, the other carrier arms have swung to the left in readiness to receive the work from the various stations.

Provision has been made in the construction of the carrier arms to reverse the work when necessary, so that the same side of the plates may be presented to successive tools. This

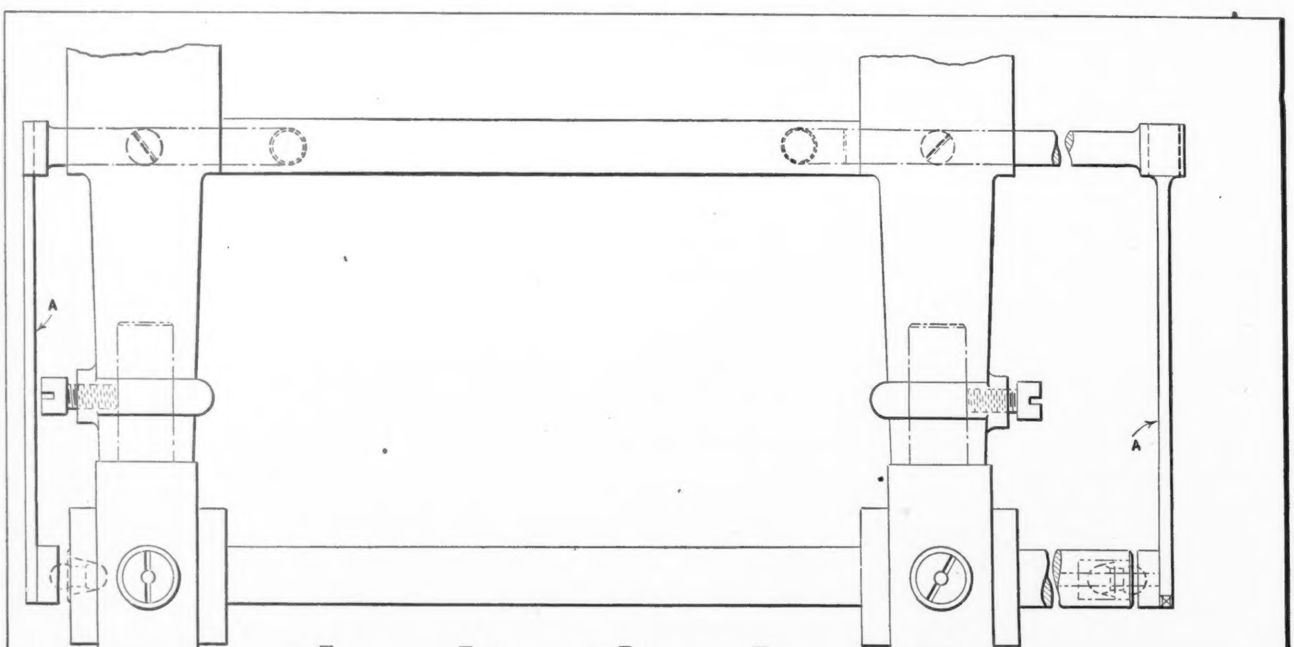


Fig. 2. Assembly of an Air Countershaft; also, at D, Partial View of an Air Chuck for Balance Cocks

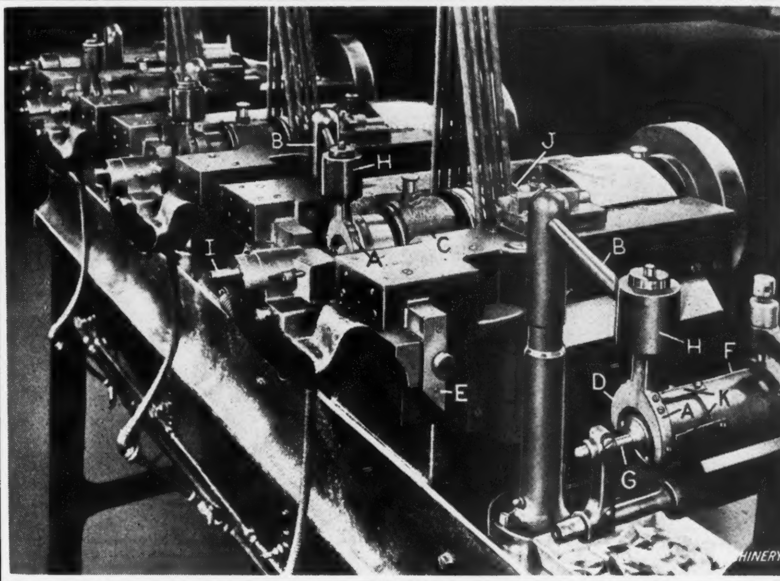


Fig. 3. Three-spindle Plate Roughing Machine for surfacing Watch Plates

is effected by an air cylinder *H* which delivers air to the arm in which the clips are carried as the port is opened at a certain point during the swing of these arms. The usual procedure in machining plates is to take two cuts on one surface at the first and second stations, so that the carrier which transfers the work between these stations must be provided with means for reversing the clip arms. Between the second and third spindles it is not necessary to reverse the work, because it should be deposited in the chuck in the third spindle in a reversed position for taking a cut on the opposite side. The tool carried in the last work station also provides for removing the sharp corners on the plates. The plunger which strips the finished work from the clip at the delivery station and forces it into the magazine is operated by a cam and lever, and when this tube is full it is an indication that the feed magazine at the opposite end is empty and must be replenished with fresh work.

As soon as the carrier arms have positioned the work in front of each chuck, the air plunger *I* advances with sufficient force to overcome the pressure exerted by a spring at the rear of each spindle and forces the work from the clips into the chuck jaws, which are thus opened and in readiness to receive the work. As soon as the air plunger recedes, the coil spring causes the chuck to advance sufficiently to grip the work. During the machining of each surface, the carrier arms swing back from the position shown in the illustration to a neutral position, where they remain until the work is almost complete, at which time they resume their movement, placing the clips in position to receive the finished plate as soon as the air-operated chuck is released and the spring advances the chuck, and forces the work into the clips.

The pieces shown beneath the delivery magazine are barrel bridges. When these parts are handled on this machine or when train bridges are surfaced, it is necessary, on account of the peculiar shape of the chuck required for holding these parts, to stop each spindle repeatedly in the same position, as otherwise the parts could not be entered into the formed jaws of the chuck. This requires the use of a one-lobed cam which can just be seen at *J* in back of the driving pulleys of the right-hand work-spindle. As air is admitted to the countershaft to reverse the direction of rotation, the lobe on this cam is brought up against a pawl which prevents reversal beyond this predetermined point and so stops the chuck properly for receiving the work.

Multiple-head Plate Drilling Machine

Figs. 4 and 5 show front and rear views, respectively, of a five-head automatic drilling machine in which the numerous holes contained in a pillar plate are drilled, tapped, and countersunk. The plates are fed by gravity from a vertical magazine *A*, Fig. 4, in which they are suspended by spring clips according to the general arrangement described for the feed magazine used on the plate roughing machine. From its position beneath the magazine the carrier arm at the first station is raised until the chucking jaws at its end spread the spring jaws which hold the work and allow them to drop into place.

The six carrier arms oscillate in unison from an air-operated shaft, to deliver the work in various stages of completion, ready to be picked up by the spring jaws carried in chucks *B*. The work is located in these chucks above the tools, which are carried in turrets at each station and fed upward. The vertical driving spindle *C* located beneath the turret, is provided with a jaw-tooth clutch and driven by a twisted rawhide belt from the air countershaft shown at the rear of the machine, Fig. 5. One of the toothed cams carried on the camshaft *C* operates a lever to feed the spindle *C*, Fig. 4, upward against spring tension. This upward feeding movement is timed with the index of the turret, so that as the various spindles are successively brought into alignment with the driver, these may be rotated by the engagement of the clutch members on the two aligned spindles. Obviously, the use of the air countershaft permits the control of the direction of rotation

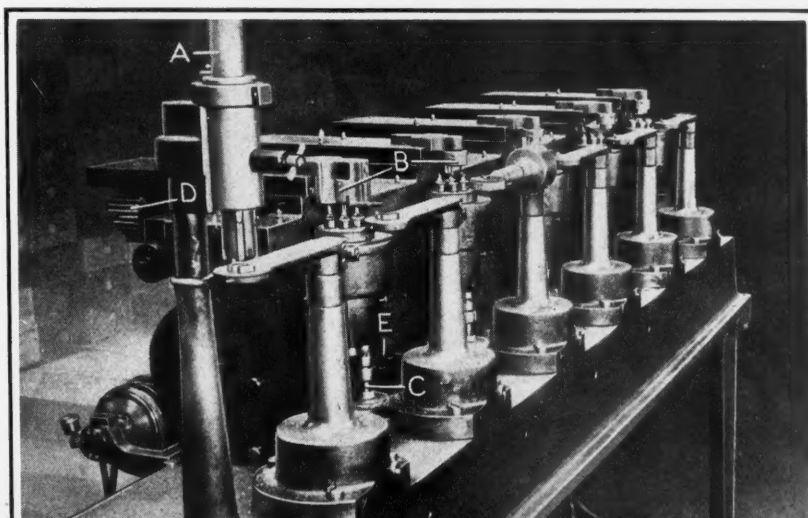


Fig. 4. Multiple-head Plate Drilling Machine of the Full Automatic Type

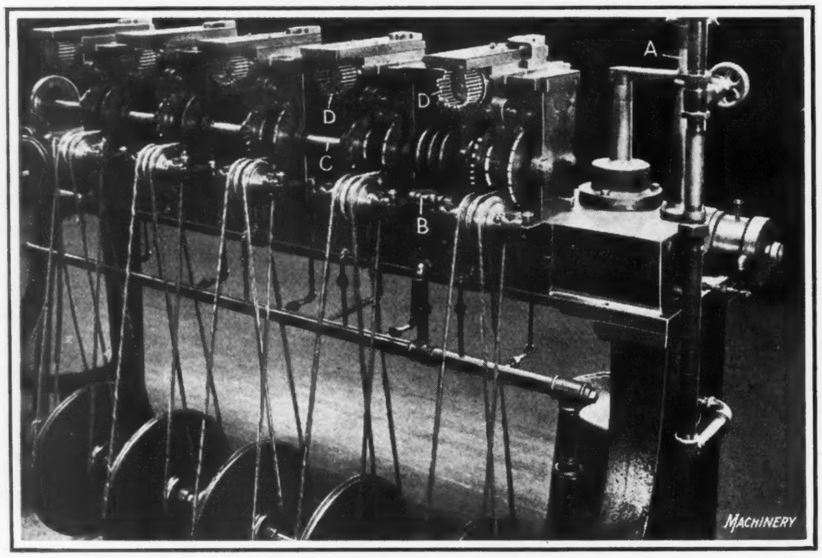


Fig. 5. Rear of Machine illustrated in Fig. 4, showing Cams for Regulation of Air Valves, Stops for limiting Slide Travel, and Driving Arrangement

as is required in the performance of tapping operations.

With each index movement of the turret, there must, of course, be a corresponding relocation of the chuck in which the work is held, and compressed air is used for this purpose. Compound lateral and longitudinal movements of the chuck are obtained by the use of a cross-slide which rides on another slide that is capable of longitudinal movement. The release of the air valves for controlling these slides is effected by a series of cams carried on the camshaft *C*, Fig. 5, and the movements thus imparted to the top slide are limited by the stop-pins shown at *D*. The plate in which the stop-pins are carried, is indexed to bring successive pins into alignment with the bumper carried at the rear of the slide, so that by adjusting the amount of projection of these pins, the length of travel permitted by the application of air is controlled. The index plate is notched similarly to that shown at the right-hand end of the single-head drilling machine illustrated in Fig. 6, and is held in position by a pawl, which is located on the under side. This pawl is not discernible in the illustration Fig. 5.

There is another set of stops used for controlling the longitudinal movement of the under slide, but these stops are not shown in the illustration, being located at right angles to those shown and on the foot-end side of each station. Movement of the slides is positive and quick, and this series of movements in which the top slide reverses after each operation, slides longitudinally a predetermined amount, and is again advanced, must all transpire while the indexing of the turret is occurring.

Among other tools, the first turret carries three drills for drilling three dial foot holes which extend through the plate and which are used subsequently both in the remaining stations of this machine and in other machines to locate the plates by suitable dowel-pins. At the first station, the work is drawn up against a locating member in the chuck by a finger at the front, but at the other stations the pins only are used as a locating means. The arrangement of the driving mechanism is illustrated in Fig. 5, which shows the driving shaft, and the belting arrangement to the air countershaft by means of which the tools are reversed. This illustration also enables the air line installation employed on the machine to be seen and the levers *B* which are operated by the cams shown above them to actuate the air-valves. The front ends of these levers are shown at *E* in Fig. 4. The camshaft is driven by a worm and worm-wheel from a sheave shown at the extreme foot end of the machine, Fig. 5.

Single-head Drilling Machine

The single-head drilling machine illustrated in Fig. 6 is similar in operation to the multiple-head machine just

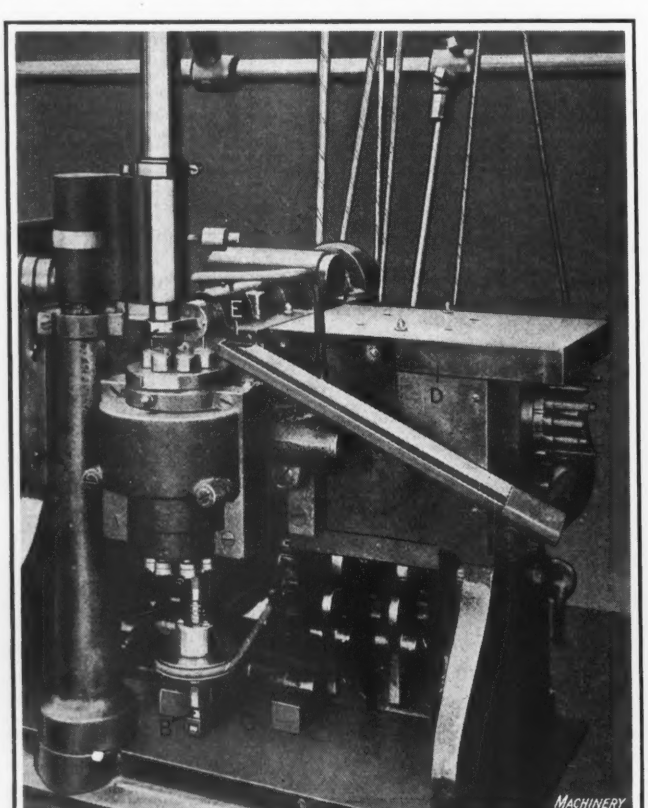


Fig. 6. Single-head Plate Drilling Machine operated similarly to Machine shown in Fig. 5

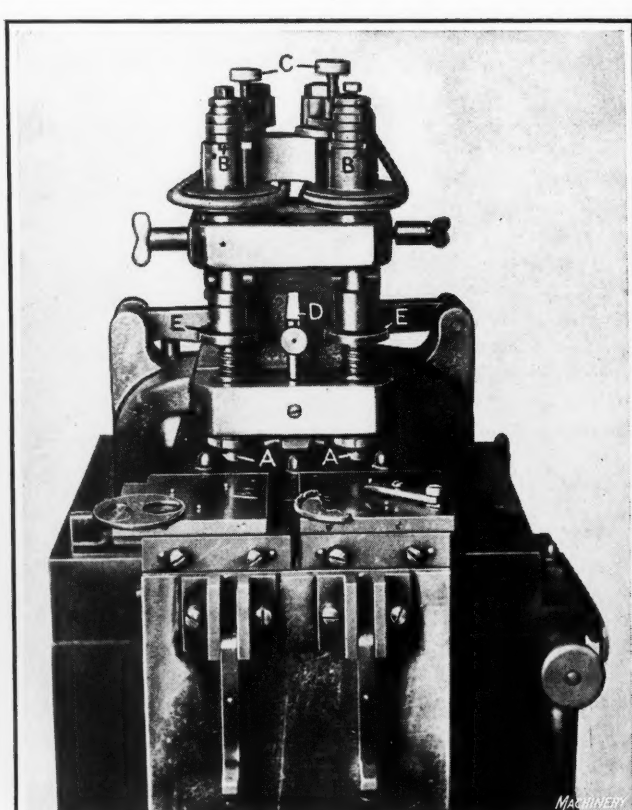


Fig. 7. Machine for taper-turning and taper-boring Steady Pins and Holes

described. Drilling, counterboring, and tapping operations are performed on train bridges, balance cocks, and pallet bridges on this machine. The feed arrangement, however, is somewhat different, this machine having its magazine located directly over the chuck and being equipped to deposit the pieces one at a time into the chuck, at the rate determined by the operation of the air valve which controls this release. The design of the chuck used in the operation shown in Fig. 6 is illustrated at *D*, Fig. 2. This chuck is used for holding balance cocks, and the position of the work is indicated by heavy dotted lines. A hinged finger *E* is operated by an air plunger, which bears against its outer end and forces the balance cock against the locating surfaces within the depression which carries them.

In Fig. 6 this chuck is indicated at *A* in the position that it would occupy during the drilling and tapping operations. The slide in which this work-holding chuck is mounted recedes, as determined by the operation of the air valves, to permit the chuck to be turned over and the opposite side of the work presented to the tools. This permits one chucking of the parts for drilling and tapping many more holes than would otherwise be possible. The levers and cams for operating the valves that control the movements of the slide, the indexing of the turret, and the feed of the spindles, are shown within the frame of the machine. The drive for the spindles is through driver *B* which is raised to bring the clutch on its upper end in engagement with the clutch on the spindles, by the cam-operated lever *C*, and this lever then transmits the feed to the spindles from a suitable cam. Disengagement of the driving spindle clutch to permit indexing of the turret is also taken care of by the design of this feed-cam.

Slide *D* in which the cross-slide *E* is carried is limited in its movements by a series of stop-pins carried in the plate at the right-hand end of the machine. Obviously, slide *D* must not only move to locate the work (in conjunction with the cross-slide) but also must traverse to the right in order to bring the chuck into position for discharging the work into the chute shown at the front of the machine. The opening of the chuck is accomplished by the release of the air which controls its action, as described in referring to the chuck in connection with Fig. 3.

Taper Turning and Boring Machine for Steady Pins

A machine for turning and boring steady pins is illustrated in Fig. 7. It is of the bench type and is used for simultaneously taper-boring previously drilled straight holes in pillar plates and for taper-turning a straight pin screwed into the barrel bridge. The machine provides for accomplishing these two operations with such a degree of accuracy that regardless of the slight variations in thickness of the two parts, they may subsequently be assembled with the assurance that the two tapers will accurately agree. The pillar plate is located on a finished table-plate which has three locating pins for engaging the dial foot holes in the pillar plate. Likewise, the barrel bridge is located by pins, and is clamped down by a suitable strap, as shown at the right in the illustration. These supporting tables are mounted on the machine so that they are free to slide, and they may be replaced when handling different sizes of watch parts.

The table of the machine is fed upward by air pressure until the work is brought in contact with stops *A*, which surround each tool, and at this point the tools start to operate so that the tapered surfaces produced by each, commence with relation to the top of the work and so assure the proper fit. Each spindle carries a tool-holder and a taper wedge against which the tools bear, and this cam action swings the point of the tool to produce the desired taper as the table continues to feed upward. At the top of the spindles there are specially designed clutches *B* which relieve the strain produced on the spindles by the belts, and thus diminish the amount of wear on the bearings. Screws *C* enable the adjustment of each spindle to be made as relocation of the vertical position of the spindles is required. A swinging key *D*, positioned between two spindles, may be dropped into a slot in either collar *E* to lock the spindle for convenience in removing or adjusting the tools. The positioning of these collars on the spindle is accomplished by the two gages shown suspended from the front of the machine; these are swung up on their hinges so as to engage the collars when making the setting. A pillar plate in which the holes are taper-bored is shown on the table at the left, and a barrel bridge at the right.

A description of additional types of watch-making machines will be given in the second installment of this series, which will appear in September MACHINERY.

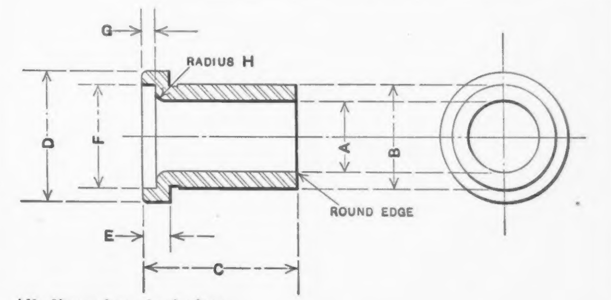
* * *

DRILL BUSHINGS WITH LUBRICANT RETAINING FEATURE

By F. W. SHUMARD

When parts made from drop-forgings, aluminum, or some of the various alloys are to be drilled in a jig, the use of a cutting compound or soluble oil is necessary. A large percentage of the lubricant employed, however, usually does not enter the drill bushing. Unless the lubricant is fed from a pipe line having a continuous flow, it is general practice to apply it to the tool with an oil-can or brush, and much of it is lost in this way, especially if the tool is revolving at high speed.

DIMENSIONS OF LUBRICANT-RETAINING DRILL BUSHINGS



All dimensions in inches.

A	B	C	D	E	F	G	H
1/16	3/16	7/16	5/16	3/32	7/32	1/32	1/32
⅛	¼	½	⅜	3/32	¼	1/32	1/32
3/16	5/16	9/16	½	⅛	5/16	1/16	1/32
¼	7/16	11/16	⅝	⅛	7/16	1/16	1/16
5/16	½	¾	11/16	5/32	½	1/16	1/16
⅜	9/16	13/16	¾	5/32	9/16	1/16	1/16
7/16	⅝	1	13/16	3/16	⅝	3/32	1/16
½	¾	1⅛	15/16	3/16	¾	3/32	1/16
9/16	13/16	1¼	1 1/16	7/32	13/16	3/32	3/32
⅝	⅞	1⅜	1⅛	7/32	⅞	3/32	3/32
11/16	15/16	1½	1 3/16	¼	15/16	3/32	3/32
¾	1 1/16	1⅝	1 5/16	¼	1 1/16	3/32	3/32
13/16	1⅛	1¾	1 7/16	¼	1⅛	3/32	3/32
⅞	1¼	1⅞	1 9/16	9/32	1¼	⅛	3/32
15/16	1 5/16	2	1 11/16	9/32	1 5/16	⅛	⅛
1	1⅜	2⅛	1 13/16	5/16	1⅜	⅛	⅛

Machinery

The accompanying table gives the dimensions of a line of drill bushings that are counterbored at the flanged end. This counterbore acts as a reservoir, or retaining chamber for the lubricant and thereby saves much of the fluid which would ordinarily be wasted. The over-all length *C*, as given, allows for a tool bearing length of about twice the drill diameter, which is standard practice for drills of ¼-inch diameter and larger. Drawings showing bushing details should always specify the rounding of the bottom edge of the hole, since a sharp edge causes the cutting tool to wear rapidly.

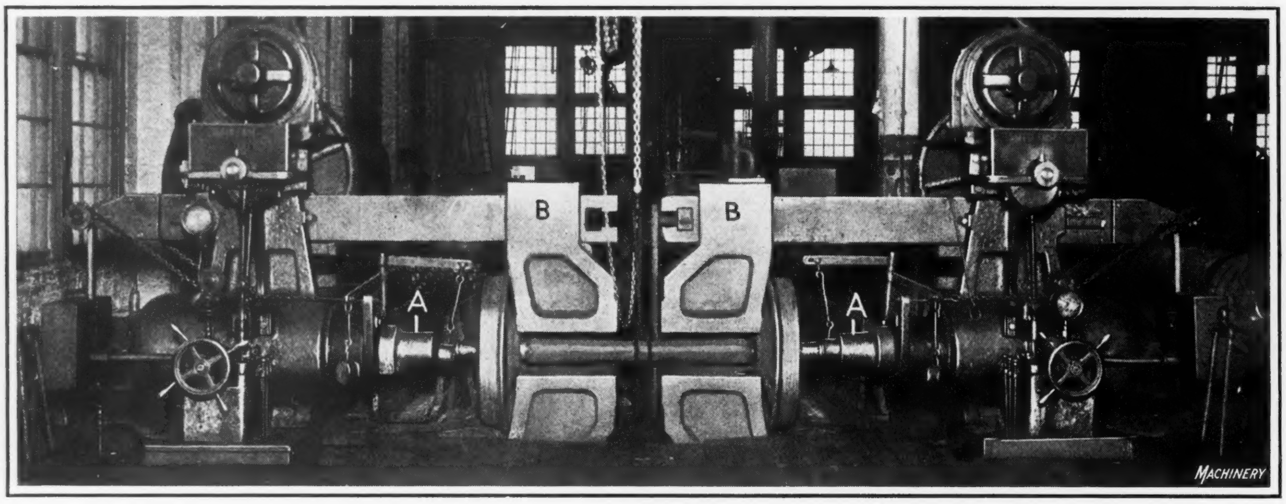


Fig. 1. Duplex Hydraulic Press used for pressing Car Wheels off their Axles

Railway Machine Shop Practice

Methods of Procedure in Making Common Types of Repairs that are Required on Passenger and Freight Cars—Fifth of a Series of Articles

AMONG the commoner jobs which come to the car repair department of railway machine shops, mention may be made of the re-turning of wheel treads, and of the journal bearings and wheel fits on the axle. Where it is required to re-turn the treads of a pair of wheels that have already been pressed on an axle, it will be apparent that considerable time would be saved by being able to handle this work without removing the wheels from their axle. Also, if the treads of both wheels could be turned simultaneously, a proportionate saving would be effected. Provision for accomplishing both these results has been made in the design of a machine built by the Niles Tool Works of the Niles-Bement-Pond Co., in Hamilton, Ohio. It consists of a machine set in a pit, so that the car wheels on their axle can be rolled into place for machining without lifting them from the floor.

A machine of this type is shown in operation in Fig. 2. There is a large herringbone driving gear at the center of the machine, which has a removable segment in its rim. This segment can be taken out to admit the axle carrying the wheels that are to have their treads re-turned. The axle is chucked at the middle, and there are two toolposts, one on each side of the driving gear, carrying tools that simultaneously turn the two wheel treads. In re-turning a pair of wheels in this way, a sequence of tools is used. Roughing and intermediate cuts are taken with suitably shaped tools, and a final finish-turning operation is performed with a formed tool that fits over both the flange and the tapered tread of the wheel and insures turning the work to exactly the required form. Gages of the form shown at *A* are employed to refinish all of the wheels on a car, to exactly the same size.

Pressing Wheels off their Axles

Fig. 1 illustrates a duplex hydraulic press built by the Niles-Bement-Pond Co., 111 Broadway, New York City, which is used for simultaneously pressing two wheels on or off their axles. In this illustration, the machine is shown pressing two wheels off their axles in order to re-turn the journals and the fits for the wheels. Tracks are laid in the floor to facilitate rolling the wheels up into place between the rams of the press. The two plungers *A* occupy a fixed position, and the rams *B* are drawn away from the work, so that they pull the wheels off their fits on the axle. After

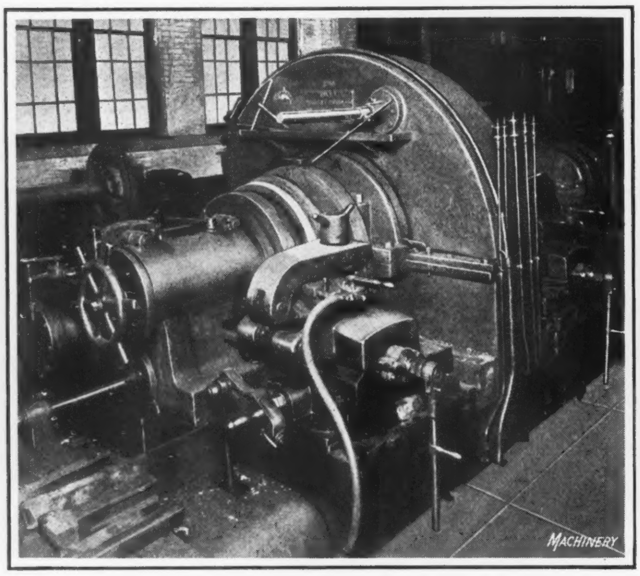


Fig. 2. Car-wheel Lathe used for re-turning Treads of Wheels while in Place on their Axle

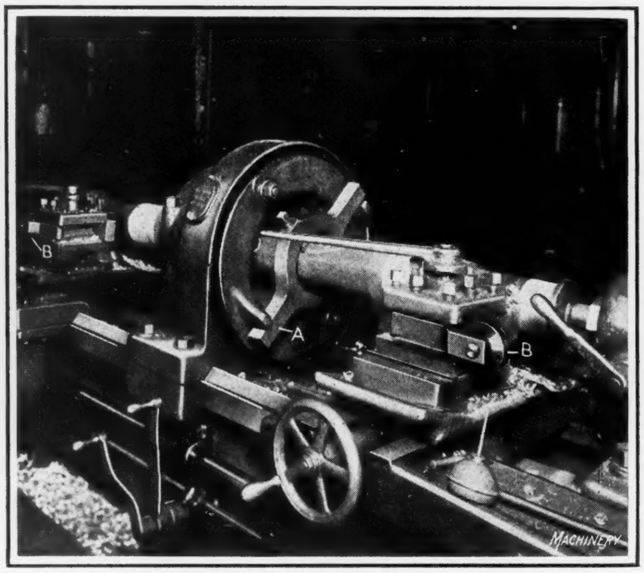


Fig. 3. Duplex Axle Lathe with Center Drive, used for turning Journals and Wheel Fits on Axles

this has been done, the axle is ready to go to a special type of lathe on which the required re-turning operations are performed.

Re-turning the Journals and Wheel Fits on Car Axles

Fig. 3 illustrates a duplex axle-turning machine built by the Putnam Machine Co., of Fitchburg, Mass., which is equipped with two toolposts and a centrally located chuck, so that provision may be made for simultaneously refinishing the two wheel fits and the two journals at opposite ends of an axle. It will be seen that a double-ended driving dog *A* is attached to the axle, and the tails of this dog come into contact with drivers on the centrally located driving gear, thus providing for rotating the work from the middle so that a carriage and toolpost can be mounted at each end of the lathe. It will be seen that a turret toolpost is provided on each of the carriages, and these toolposts carry the required sequence of tools for the performance of rough- and finish-turning operations. After these cuts have been taken, the final operation is performed, which consists of burnishing. This is done by means of a roller *B* carried by a tool shank held by each of the turret toolposts. Each roller is made of hardened steel, and after the finishing cut has been taken, it is pressed hard against the turned surface of the work; then the carriage movement provides for feeding this roller along the turned surfaces while the work rotates continuously. Experience has shown that the application of this method provides for rolling or burnishing down the surface of the work and imparting to it an excellent finish. The three jobs illustrated in Figs. 1 to 3 are shown in process in the Burnside shops of the Illinois Central Railroad Co., in Chicago, Ill.

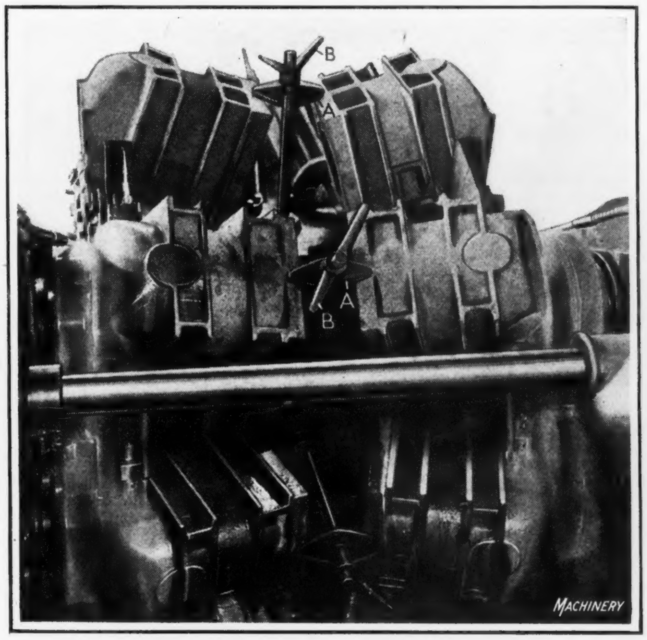


Fig. 4. Continuous Rotary Milling Machine for milling Cover Seat on Malleable Iron Railway Car Journal Boxes

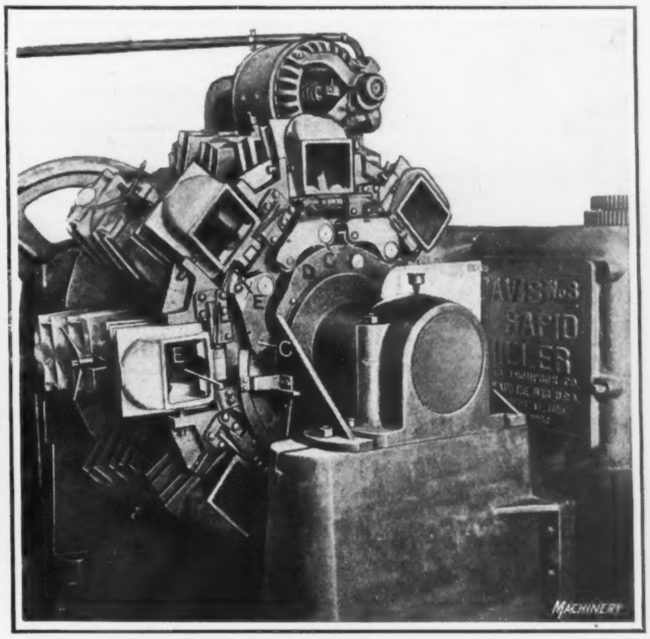


Fig. 5. Close-up View of the Work, showing Hand-operated Auxiliary Clamps which hold Each Casting at the Center

Special Continuous Milling Machine for Railway Car Journal Boxes

To provide for milling malleable iron railway car journal boxes in quantities, the Davis & Thompson Co., 251 Reed St., Milwaukee, Wis., has recently placed on the market the continuous rotary miller which is shown in operation in Figs. 4 and 5. With a plain milling machine, an operator was able to mill 220 journal boxes in a ten-hour day, but owing to the reduction of idle time of both the machine and the operator effected through applying the continuous rotary principle of milling, this machine has produced a full day's output at the rate of 105 castings per hour. However, this placed too heavy a demand on the operator for continuous production, although the machine is found capable of working at the rate of 80 journal box castings per hour without over-exertion on the part of the operator.

An important point in this connection is the fact that the work-holding fixture provided on this machine takes four different kinds of journal boxes, that is, practically all types that are in common use on American railways at the present time. The end of the journal box opposite the face to be milled rests on a small bracket which prevents it from tipping downward. When the operator has put two journal box castings into place, he simply slips on a slotted clamp *A*, Fig. 4, and tightens the wing-nut *B*, which prevents the work from slipping. As the drum of the continuous milling machine rotates, the roller mounted on each locking lever *C*, Fig. 5, runs up on a cam *D*, pushing a hardened pin *E* into the eye of the car journal box, and holding it in position while milling.

To those who are familiar with the general features of the continuous rotary millers built by the Davis & Thompson Co., it will be apparent that the present machine follows features of the previously established lines of design by having the two sides of the same general construction. The cutters are freely lubricated as shown in Fig. 4, in which the light streaks on the journal box show the lubrication flowing over the cutters and work. This machine is set up on a concrete foundation and returns all of the lubricant to a settling tank in the base of the machine, from which it is drawn for subsequent use.

* * *

The airship recently built by William Beardmore & Co., Ltd., England, and designed by the Admiralty for naval service, but which has been fitted with a passenger car providing day and night accommodations for fifty persons, is said to resemble in structure the airship which completed the double journey across the Atlantic in July, 1919. The actual over-all length of the new airship is 672 feet 2 inches, while the maximum diameter of the hull is 78 feet 9 inches. The height from the bumping-box to the top of the hull structure is 91 feet 7 inches. There are nineteen gas bags with a total capacity of 2,196,000 cubic feet, which give a gross lifting capacity of 64 tons under normal conditions. Of this, 16 tons is available for fuel, passengers, and freight. The aggregate horsepower of the five engines is 1570. The maximum speed with this power equipment is 65 miles per hour, while the normal cruising speed is about 50 miles per hour. At the latter speed, a range of action of a little more than 4000 miles is obtainable.

Organization of Large Contract Plants

First of a Series of Articles Dealing with the Organization of Plants Making a Variety of Products, and the Establishment of Planning, Dispatching, and Recording Systems

By GEORGE H. SHEPARD, Professor of Industrial Engineering and Management, Purdue University

PLANNING and dispatching are often the first principles of management to be applied in the organization of a plant manufacturing a large variety of products on a contract basis, or engaged in repair work, and as a result of such planning much practical benefit is derived almost immediately. This is due to the importance of foresight, advance preparation, coordination, and teamwork among the different departments, and to the impossibility of securing these advantages except through planning the procedure of the various jobs through the shops. The development of planning and dispatching systems includes the installation of adequate and reliable recording systems.

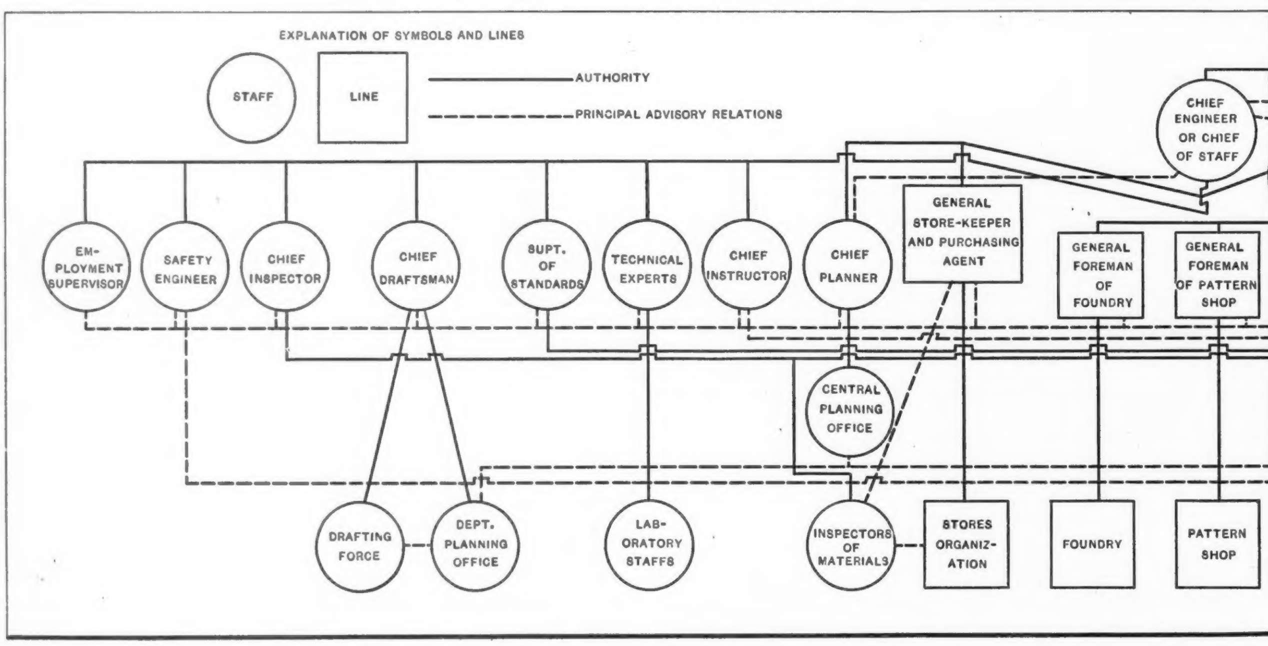


Fig. 1. Graphical Presentation of a Model Line and Staff Organization for a Large Jobbing or Contract Plant manufacturing

A fundamental principle of planning is to furnish definite information to shop executives as to the priority of work. Such data are often lacking, and, as shop supervisors are subjected to conflicting and insistent demands for deliveries from many different sources, the result is the starting and stopping of jobs in obedience to the last, most insistent, or most authoritative demand; the tearing down of set-ups only partly used; and general inefficiency.

Establishing Priority List of Jobs in Plant

The complete establishment of priority on all work is an ideal which is only gradually approachable and, in one hundred per cent realization, is unattainable and probably undesirable. However, it is both feasible and desirable to publish the priority of the main jobs of the plant. The way in which such a list may be arranged is illustrated in Fig. 3. This priority list should form the basis of the entire planning of the plant; its preparation is worthy of the personal attention of the general manager, and it should be prepared at a routine daily meeting of the general manager, the works manager, the chief engineer, and such department heads as the general manager considers should attend. Such meetings are usually held for other purposes, and so should not require much additional time. The chief planner, or, as he is frequently called, the production manager, should submit the order of jobs for the next working day at each meeting for revision and approval; its consideration requires only brief attention by those present.

A copy of the approved order should then be furnished promptly to every immediate subordinate of the works manager and the chief engineer, to the chief draftsman, heads of laboratory staffs, general and other foremen, and departmental chief planners. The laying out of schedules such as shown in Fig. 3 requires the immediate installation of the rudimentary planning staff known as "order chasers." These men watch the progress of orders, call the attention of the departmental supervisors to any job that is lagging, trace needed parts, and, in general, act as the direct representatives of the superintendents and foremen to keep up the necessary watchfulness over such orders as must come through on a close schedule, and help these department heads to attain the necessary cooperation of workmen. Order chasers are, however, only a makeshift, because a reasonable number of them cannot follow up more than a few of the most important orders.

Insufficient Number of Shop Executives in Contract Plants

The further development of planning and dispatching systems must proceed step by step with improvements in other directions, of which one of the most important is that of establishing an efficient organization. Contract or jobbing shops are likely to have an insufficient number of shop executives who are burdened with details and especially those of planning and order chasing.

The continual variation of contract work makes it difficult to produce similar parts in quantities sufficient to warrant the attention of those high up in the organization. This condition necessitates machines designed for general work, instead of specialized types; all-around mechanics instead of machine operators; and abundant and skilled super-

vision of the work, more often than detailed study by technicians in a distant office or laboratory. Jobbing work usually includes a great deal of repair work, and as many of these jobs are emergency cases, most of them are in a rush. This condition calls for prompt and correct decisions by the men in immediate charge of the work, with comparative freedom from referring matters to those higher up for decision. The correct making of such decisions can only be obtained by having a strong, adequate, and competent supervisory force.

Organization of a Large Contract Plant

The organization and instruction of a supervisory force are important factors in the management of a contract plant. Attempts have been made to set hard and fast rules governing the number of supervisors of different grades there should be in a shop, as compared with the number of mechanics or other workmen, but such attempts have been incorrect in principle. An assistant foreman in a well-ordered shop, which is entirely visible from his desk, may successfully direct a large force of skilled mechanics. Another, with unskilled or semi-skilled men scattered about in positions of which no general view is possible, may find four or five men all that he can take care of. A study of individual conditions is necessary to make a correct decision as to the number of supervisors required.

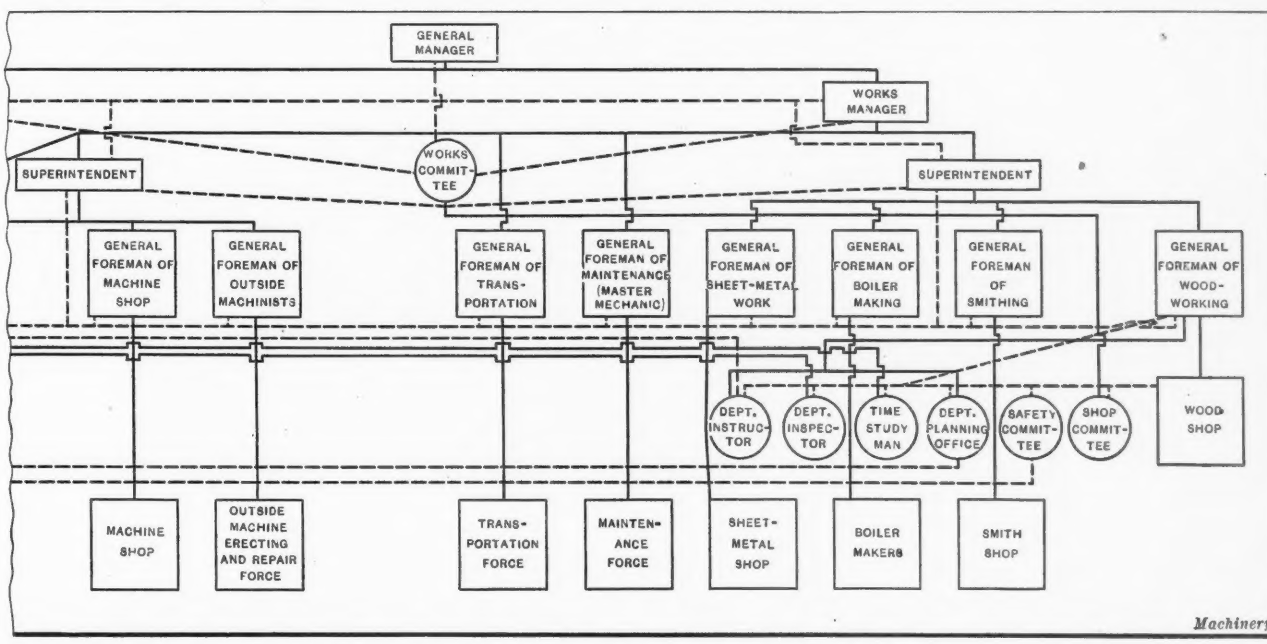
The organization of a contract wood- and metal-working plant employing about six thousand men is illustrated diagrammatically in Fig. 1, in which the departments, foremen, superintendents, etc., considered in the "line" section of the organization, are represented by squares, while those considered in the "staff" section are denoted by circles. Attention is called to several points in connection with this diagram. Much repairing and erecting is done outside the plant on the premises of customers; nevertheless, a unified control is preserved at all times by the works manager, through the superintendent and foremen. All activities other than those directly connected with production are organized as staff, and staff functions are entirely advisory. The purpose of this arrangement is to obtain undivided authority and responsibility in the line management of managers, superintendents, and foremen, and, at the same time, to give the line officers the benefit of expert advice from those on the staff.

In order to secure the necessary independence of inspection, the inspecting staff is not under any line authority below that of the general manager. The inspection force of any department is in an advisory relation to the department and under the authority of the chief inspector only, who is under the chief of staff, the latter, in turn, being under the general manager. The inspection staff is, of course, authoritative in passing on the quality of products.

The technical experts are organized strictly as staff, and are without authority over the directly productive organization. These technicians are often organized as line superintendents with functional authority over the foremen. In a manufacturing plant where all activities are capable of a much higher standardization and much closer definition, this scheme may work satisfactorily, though, in general, it is better to preserve unified control in the line and to put all functional control into the staff. In a contract plant, however, it is impossible to differentiate functions clearly enough to avoid conflict of authority and division of responsibility, if the technical experts are made line officers. The line is thus made completely and solely responsible for production, and this burden of responsibility will cause line officers to seek and follow competent staff advice.

Planning is shown under functional control, the works manager having authority over the chief planner as to what work shall be planned, the priority the various jobs shall be given, and the different dates to be scheduled for the productive departments. The chief of staff has authority over the chief planner as to methods of planning, dispatching and keeping records, and the use of standards of labor, materials, etc., as determined by the superintendent of standards who is commonly known as the head of the "rates" or "time study" department. Authority over any departmental planning office is similarly functionalized between the line head of the department to which it is attached and the chief planner, through the central planning office.

In order to plan and dispatch a contract plant successfully, it is necessary to decentralize the planning organization and function, and to allow ample discretion and authority to the people on the job. As to the line organization, the pattern, foundry, and machine shops and the outside machine erecting and repair force, each under its own general foreman, are brought together under one superintendent, because of the close interdependence of these four shops. The sheet-metal, boiler, and smith shops are brought together for the same reason, and the wood shop is added to balance this superintendency with the other. The superintendents are likely to be omitted in an organization, leaving every general foreman to report directly to the works manager. This method results in overburdening the latter with details that should be handled by subordinates, and also in



a Diversified Line of Products. All Activities Other than those directly connected with Production are organized as Staff

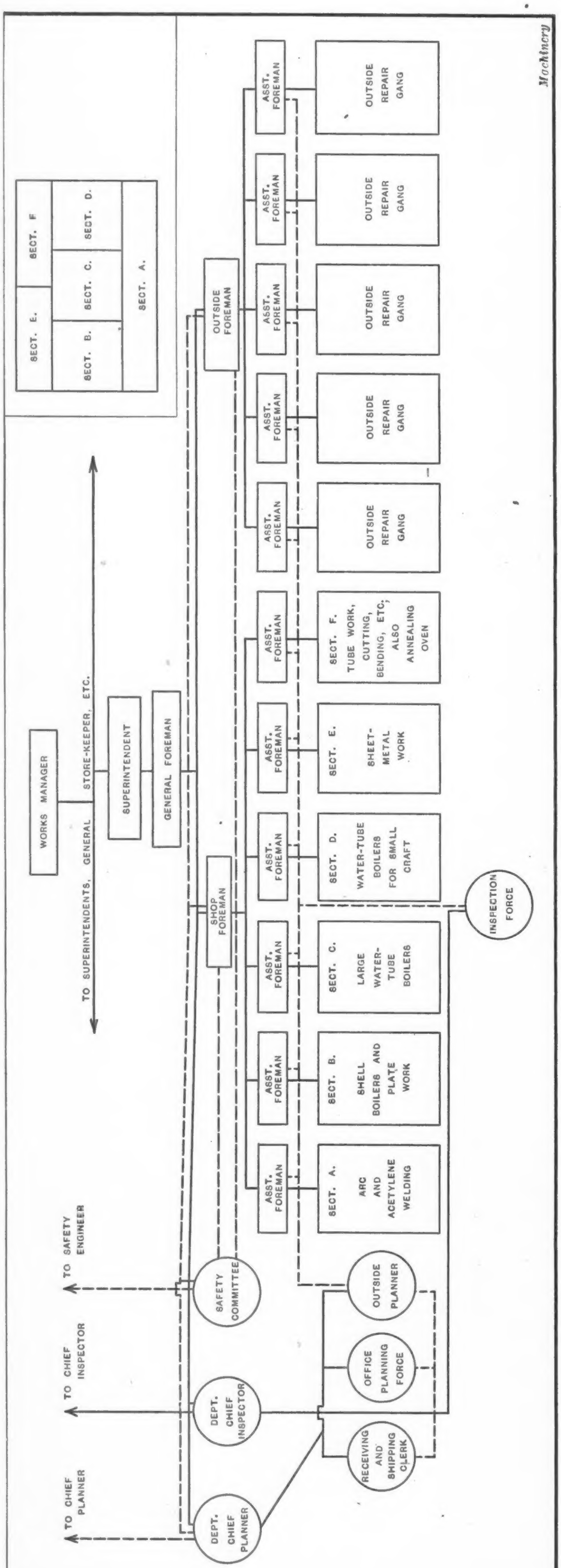


Fig. 2. Diagram illustrating Manner in which the Management of a Large Boiler Shop was reorganized for Greater Efficiency

poorer coordination between different shops than could be obtained if a closely related group had a line chief of its own.

The general store keeper and purchasing agent is made direct line subordinate to the works manager, so as to give the latter the necessary control of materials. It is common to find the purchasing agent of equal rank with the works manager and reporting directly to the general manager. In order to relieve shop foremen of attention to maintenance and transportation, to make sure of having equipment in condition for use and of having transportation equipment on hand, and to avoid breakdown of plans from failure in these respects, transportation and maintenance of equipment are each organized under a general foreman, who is responsible directly to the works manager. The plant under consideration was strongly unionized, and the representatives of the workmen constituted the works committee and the shop committee as shown. It would be unnecessary to give all the details of the departmental organizations; therefore only the departmental staff of the woodworking shop and its relation to the higher staff organization is shown.

Reorganization of a Boiler Shop

The reorganization of a boiler shop, of which the present managing arrangement is illustrated in Fig. 2, was undertaken with the following aims in view: To obtain adequate line supervision; to functionalize the line supervision; to locate responsibility more definitely; and to obtain adequate planning, dispatching, inspection, and instruction.

The assistant foremen in this shop had previously no definite sections, but were assigned by the foremen to certain jobs. An examination of the shop showed that it was adapted to the localization of work, as shown in the upper right-hand corner of Fig. 2, in which the classes of work handled in the different sections are as follows: Section A, arc and acetylene welding; Section B, shell boilers, stacks, condenser shells, and other plate work; Section C, large water-tube boilers; Section D, repairs to water-tube boilers of a special type; Section E, casings, small sheet-metal stacks, ash-pans and other sheet-metal work; and Section F, annealing and preliminary work on tubes, receiving them as they come from the tube mills and delivering them to Sections B, C, or D for installation in boilers.

By this localization it was possible to select assistant foremen who were specialists in the several lines of work, giving each of them supervision over his own specialty, and to keep the work on that specialty concentrated in a definite section of the shop. The outside work of overhauling, repair, and erection is, of course, variable in quantity and often extremely urgent. This requires the whole organization to be flexible, and so foremen are given authority to make such temporary shifts or reassignments of their personnel as is necessary. The usual practice, in case more assistant foremen are needed outside, is for the general foreman to draw them from the shop. The shop foreman then temporarily divides the sections of those assistant foremen taken away among those who remain. When the outside work lessens, the general foreman first returns shop assistant foremen to their respective sections and then sends temporarily spare outside assistant foremen to the shop foreman.

Outside Planners and Meetings of Shop Supervisors

This shop has a large amount of work which must first be disassembled and examined, repairs then being made as found necessary. In work of this kind, planning problems can best be solved by employing outside or "liaison" planners who serve as connecting links between the planning office and the shop. These men spend a great deal of time in the shop personally examining jobs, and keep the planning office in touch with developments. One of their main functions is to exercise that foresight which is so often lacking in repair work, and especially in emergency repairs. As soon as the need for any work appears, they also make preparations for its efficient performance. In large shops the chief outside planner has the rank of an assistant foreman and decides the details of a blanket order for overhaul and repairs. The use of competent men in these positions is a valuable source of economy. The departmental chief planner has the earliest information as to what materials will be needed and when, and should have immediate information concerning both arrivals and shipments. It is therefore advisable to put the departmental receiving and shipping clerk directly under his supervision.

ORDER OF JOBS.

Destroy previous lists.

Jan. 3,1919.

(Jobs having immediate right of way.)

Serial No.	Job No.	Customer.	Completion date required.
1	592	Michigan T.T.Co.	1 - 19 -19.
2	361	Bouker	
3	637	Michigan T.T.Co.	

(After jobs having immediate right of way, the following have priority in the order of their serial numbers.)

Serial No.	Job. No.	Customer.	Completion date required.
1	789	Maticka	1 - 10 -19.
2	1 128	Lambert	1 - 12 -19
3	1 005	Westover	1 - 11 -19
4	672	Mugford	1 - 14 -19
5	671	Montgomery	1 - 4 -19
6	969	Ward	1 - 21 -19
7	739	Ohio Mfg. Co.	1 - 21 -19
8	711	" " "	1 - 21 -19
9	521	Hull	1 - 11 -19
10	276	R.L. Barnes	1 - 8 -19
11	1 876	Lykins	1 - 25 -19
12	957	Wando	
13	343	Balch	1 - 31 -19
14	369	Caldwell	1 - 31 -19
15	Miscellaneous urgent jobs.		
16	1010	50. ft. steamers, new type.	
17	9193	Old power plant, installation of new units.	

(New jobs to be started soon).

Serial No.	Job No.	Customer.	Completion date required.
1	633	Massachusetts Motor Co.	2 - 4 -19
2	911	Vermont Tractor	
3	579	Nederlanden	2 - 8 -19
4	320	Arkansas Farm Imp.Co.	1 -31 -19
5	463	F.L.A. & D. Co.	3 - 4 -19

By order of the General Manager.

William Brown O.K.
Chief Planner. W.B.

Fig. 3. Priority List showing Successive Order in which the Various Jobs in a Plant are to be completed

Meetings of shop supervisors, except meetings of managers and superintendents with the general foremen, should be held with groups only. The supervisors of one shop of a thousand men make by themselves a group as large as it is desirable to handle at once. The supervisors of smaller shops may be assembled in one meeting, bringing together shops which must cooperate closely. In a large contract machine shop, meetings which proved valuable were those especially devoted to planning. In these meetings the various foremen and the departmental chief planner were brought together daily to consider the schedules laid out by the planning office and to devise ways and means of meeting them. These meetings distinctly improved teamwork among the sections of the shop, brought out many good suggestions and greatly reduced the number of deliveries overdue.

Comment on Organization Diagrams

The organization diagrams in Figs. 1 and 2, show graphically a disadvantage of a strong line organization, in that the latter tends to separate along distant lines of cleavage from top to bottom, to the detriment, even to the destruction, of teamwork. The cross lines of staff activity correctly represent the fact that a good staff organization binds together the separate line units and produces the necessary cooperation among them. The function of the order chasers in bringing about cooperation is of permanent value. In this capacity they may well be retained as part of the fully developed planning staff. The dotted line of advisory relations connecting the departmental planning offices in Fig. 1, may then represent the activity of a modified order chaser, but this activity may be exercised through telephone or mail communication only, except where cooperation between departments is especially important or difficult. Order chasers may also be developed into the outside planner in Fig. 2.

The necessary connection between two shops may require even more attention than provided in the foregoing. Considerable trouble in this respect was experienced between a foundry and the machine shop to which most of its castings were delivered. The works manager finally ordered the chief planners of the pattern shop, foundry, and machine shop, together with a progress man from the central planning office, to meet daily. A few hours before the daily meeting, the chief planner of the machine shop sent to the chief planners of the foundry and pattern shop a list of the castings that he wanted on the next day; and, based on this, the chief planner of the foundry submitted to the meeting a list of the castings scheduled to be poured the next day. The meeting revised this list, if necessary, and finally issued a satisfactory one. These meetings proved to be very successful in producing the necessary cooperation.

The next article in this series will be published in November MACHINERY.

* * *

THE BASIC "INDUSTRY"

We frequently think of the iron and steel industry or some other industry with which we are most familiar, as being the greatest and most important of the industries of the country upon which the prosperity of business mainly depends. But after all, the present business depression has shown that the country's prosperity depends largely on the buying power of the farmer. Nearly one-third of the people of the United States—or more than 30,000,000—live on farms. Nearly 20,000,000 live in communities having a population of less than 2500 and depend for their well-being mainly upon the prosperity of the farmer. In other words, nearly one-half of the population of the United States is directly dependent upon the farms for its income and its purchasing power. When this large part of the population begins to curtail its purchases to a minimum, as has been the case since the fall in the prices of farm products, every industry in the country suffers. In 1919 the value of the farm property in the United States was estimated at more than $50,000,000,000, or more than the combined capital of all the manufacturing establishments, railroads, mines, and quarries in the country. The value of the output of the farms at pre-war prices is estimated at $8,000,000,000.

* * *

THE LYONS FAIR

The fair to be held at Lyons, France, October 1 to 15, 1921, will be of great importance in the promotion of international trade. Full particulars will be furnished by the official delegate for the United States, Emile Garden, 150 Nassau St., New York City.

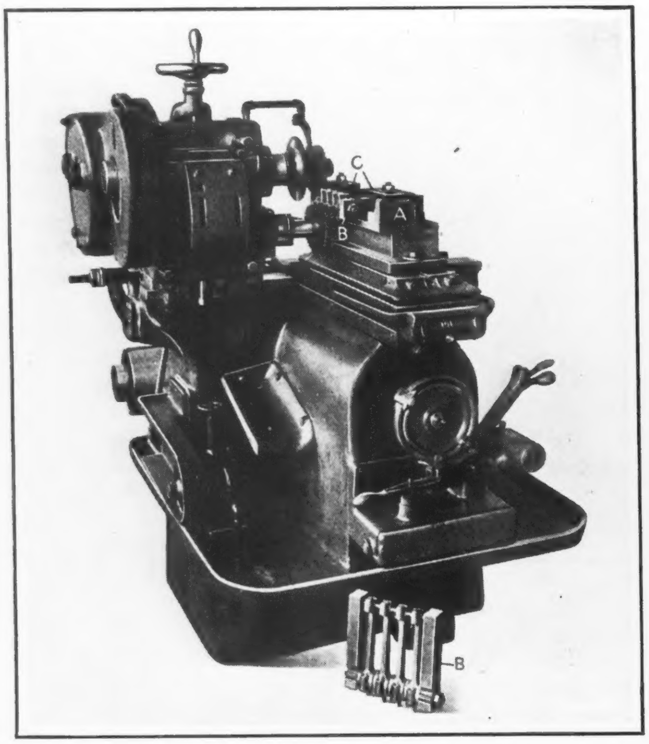


Fig. 1. Automatic Milling Machine equipped with Two-spindle Head for performing Milling Operations on Chevrolet Engine Connecting-rods

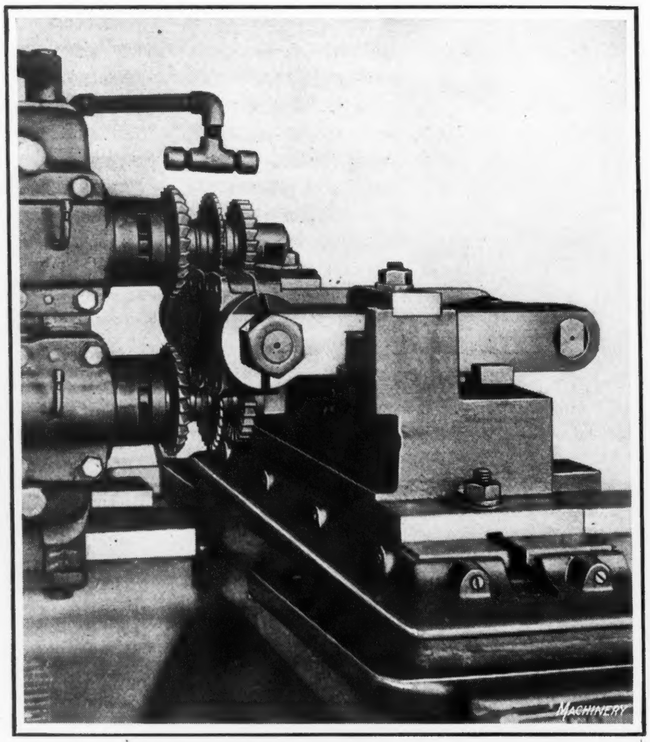


Fig. 2. Close-up View of Automatic Milling Machine equipped with a Duplex Head, as shown in Fig. 1, used for milling Hinkley Connecting-rods

Milling Automobile Connecting-rods

Equipment and Methods Used in Machining Chevrolet, Hinkley, and Duesenberg Connecting-rods

By J. M. HENRY, Engineer, Pratt & Whitney Co., Hartford, Conn.

THE writer has been very much interested in recent articles, published in MACHINERY, describing the manufacture of automobile connecting-rods for various types of motors. In this connection, he believes it would be interesting to present a description of the latest methods employed by the Pratt & Whitney Co., of Hartford, Conn., in equipping automatic milling machines of their manufacture for such work. The adaptation of a two-spindle head to the Pratt & Whitney standard machine has materially simplified the milling of rods, increased production, and cut costs to a considerable extent. A machine designed for handling Chevrolet rods is shown in Fig. 1. In this case the under side of the screw bosses is finished, the cap is cut off and the dipper on the cap, which provides for splash lubrication, is trimmed to length. The work-holding fixture is very simple. It consists of a base *A* having seats machined on it to receive the loading fixture *B*, which is held in place by two straps *C*. The loading fixture consists of a stationary strap with two arbors mounted in it, and a removable strap for loading and clamping the work. The arbors are hardened and ground to fit the crankshaft and wrist-pin holes in the connecting-rods, the large arbor being relieved to provide a two-point bearing in the crankshaft hole.

Provision for Locating the Work

As the tolerance allowed for center distance between these holes is 0.020 inch, the arbor at the wrist-pin end is made sufficiently under size to compensate for this variation. The straps at the crankshaft end, where the milling actually takes place, are cut away so that a two-point bearing is provided on the face of the cap. This is necessary as the rods are rough-forged at this point. In addition, the removable strap has bell-mouthed holes, which facilitate mounting it in place when it is ready to be clamped. The larger arbor, at the crankshaft end of the rod is threaded for a hexagonal nut which does the actual clamping of the rods, the arbor at the small end merely serving as a locating bar.

Binding of the loading fixture in the base may be expedited by the use of a single lever at the operator's end of the base, which will operate the two binding clamps at the same time; this would do away with the two hexagonal nuts and the loose wrench. A groove in the straps, corresponding to a tongue in the fixture base, provides for locating the loading fixture in the correct relation to the cutters. A close-up view of the two-spindle machine working on Hinkley connecting-rods is shown in Fig. 2.

The operations on these connecting-rods consist of cutting off caps ½ inch deep by 1⅝ inches long, cutting off the end of the dippers, and milling the ends of the screw bosses. The material is carbon steel forgings containing from 0.35 to 0.45 per cent of carbon. For milling a load of four rods, the total table travel is 8 inches, and the table is fed at the rate of 5.39 inches per minute. The maximum cutter speed, based on the diameter of the saw and the speed of spindle rotation, is 116 feet per minute. For loading and unloading four forgings, the time is one minute forty-five seconds, and thirty seconds are required to take out and replace the loading fixture *B* in the base fixture *A*. The time for completing one cycle of operations is one minute twenty-five seconds, which includes the high-speed advance of the table from the loading point to the cutting position, feeding through the work, and the return of the table at high speed to the loading position. This cycle of movements is automatically controlled. On this milling operation the production is from 100 to 120 connecting-rods per hour.

Use of a Single-spindle Machine for Milling Connecting-rods

Where the production is such that it is not necessary to use the machine continuously for the work on which it is

engaged, the selection of a single-spindle machine may be advisable, so that it may be released for other work. Such is the case on the machine used for milling Duesenberg connecting-rods, as shown in Figs. 3 and 4. Under these conditions, the loading fixture is turned over and a second cut taken on the opposite side of the work to complete the milling operation. It will be noted that the screw boss is milled on the cap at a slight bevel, thus providing for clearance. The fixture used is practically the same as the one previously described, with the exception that the arbor at the wrist-pin end is removable, being provided with a knurled handle for this purpose. The end fitting into the removable strap is squared off to give a four-point bearing for easy locating and to minimize the friction.

In this case it will be seen that five forgings are set up in the fixture at a time, and for milling such a load of work the total length of cut is 11¼ inches. The table is fed at a rate of 3.19 inches per minute and the cutter speed is 65 feet per minute. The time required for loading and unloading five pieces in the fixture is two minutes thirty seconds; and the time for placing the loading fixture in the base and clamping it in place, is forty-five seconds. For releasing the loading fixture, turning it over and reclamping on the base, an additional forty-five seconds is consumed,

Fig. 3. Automatic Milling Machine with a Single Head, used for milling Duesenberg Connecting-rod Forgings at Two Settings of the Work

and the actual cutting time for two cuts is seven minutes thirty seconds. On this complete cycle of operations the rate of production obtained is twenty-five connecting-rod forgings per hour.

* * *

The Bureau of Standards has recently completed the analysis and microscopical examination of about one dozen samples of ancient armor from the Metropolitan Museum of Art in New York City. The analysis indicates that the armor in each case was made from pure wrought iron converted into steel by the old cementation process. As the material was too thin and corroded to furnish separate samples from different layers, the carbon determination was made on the entire cross-section. The microstructure indicates that the process used in the production of the original iron was very similar to that employed in the production of wrought iron at the present time. The wrought iron was in all probability hammered into sheets which differed in hardness, the hardness being determined by the amount of carburization. The different sheets were welded together, forming a single plate which was then hammered into shape, and quenched.

MAKING HOLLOW DRILL STEEL

The method employed by the Ludlum Steel Co., Watervliet, N. Y., in the manufacture of hollow drill steel was described in a paper by P. A. E. Armstrong recently presented before the American Institute of Mining and Metallurgical Engineers. A high-grade low-carbon mild steel tube, which has been suitably cleaned by sand-blasting, is inserted in the ingot mold, and the hot metal cast around it. The tube is filled with an air-excluding material so as to prevent oxidation and scaling of the inside of the tube, a high grade of sand being generally used for the purpose. The ingots are then rolled down to the finished size, bars are cut to the required length, and the sand extracted by a special method.

During the casting of a hollow ingot by the tube method, the hole diameter is increased. The mild steel tube, when heated to the high temperature imparted by the cast metal, is enlarged and continues to enlarge until the maximum temperature is reached. The tube then shrinks while the ingot cools, and thereby relieves the exterior surface of the ingot from cracking and from the strain to which it would be subjected if the ingot were solid. The tube withstands this movement without giving way, whereas with an ingot

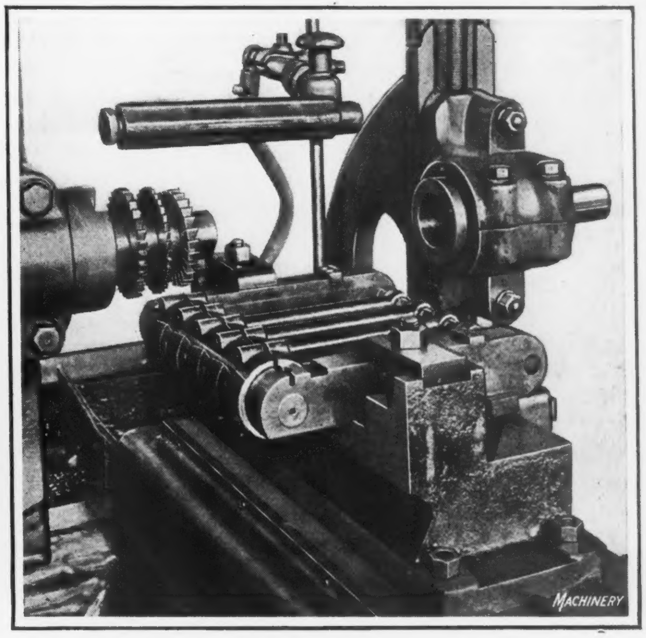


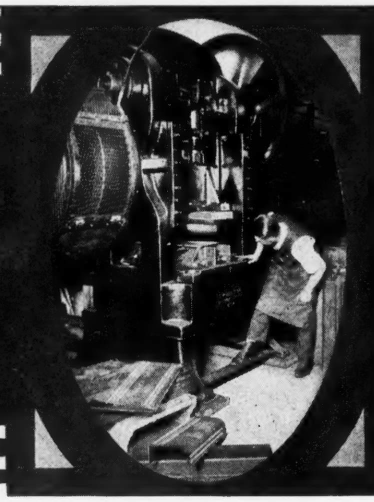
Fig. 4. Close-up View of Work, Work-holding Fixture, and Milling Cutters on Machine shown in Fig. 3. Five Forgings are held at a Time

cast hollow but without a tube, the wall of the hole would be first under tension and then under compression. These alternating stresses would naturally have a deteriorating effect on the metal.

* * *

Vibration caused by loose bearings results in excessive wheel wear unless harder wheels are used than those required when the machine is rigid, says *Grits and Grinds*, published by the Norton Co., Worcester, Mass. The hardness of the wheel, however, cannot be increased indefinitely to counteract poor machine conditions. In a plant manufacturing stoves, crystolon, vitrified wheels 20 and 24 grain, grade S, are used in a snagging operation. The grinding machines in this plant are of a heavy type and are kept in an excellent condition. The wheel wear averages about 1.7 cubic inches per day for each wheel. Another plant, where exactly the same class of work was performed with the same kind of grinding wheels, but where the equipment was lighter and not kept in nearly as good condition, had an average wheel wear of 3 cubic inches per day for each wheel. By using a wheel one grade harder, the wear was reduced to 1.7 cubic inches per wheel per day.

Safety Devices for Power Presses



Guards and Safety Measures Provided for the Power Press Equipment in the Cleveland Metal Products Co.'s Plant, Cleveland, Ohio—First of Two Articles

THE need for various types of guards for the moving parts of machines, and particularly for the protection of the operators of such machines as power presses, has resulted in the development of some very interesting designs of safety devices which are of such general applicability that they may be used on almost any machine of this classification. The Cleveland Metal Products Co., Cleveland, Ohio, whose chief product consists of "Perfection" oil stoves and Aladdin aluminum and enameled cooking utensils, has done considerable work along these lines and has equipped all of the three hundred or more power presses contained in its Platt Avenue plant with some form of protective appliance for the operator. This company does not manufacture these safety devices commercially, but realizing the help that it may confer to the metal-working trade by permitting these devices to be described in the technical press, has lent its cooperation to the end that these guards and their operating mechanisms may be here presented in detail. It is felt that the description of some of these devices will lead to a still greater application of safety devices to machine tools.

There are two general safeguards taken in the shop referred to, which may be mentioned before the devices illustrated are described. These are, first the shortening of the power press crank throw on machines engaged in blanking and punching operations. The stroke is shortened sufficiently to prevent the operator's hands extending in between the punch and die, allowing only space enough for the insertion of the stock. In some shops pliers are furnished the operators, and a set of instructions issued requiring them to use these pliers in placing the work on the die. If a man is discovered feeding the press without using the pliers, he is immediately discharged. Under such conditions, too much depends upon the ever-present human tendency to take a chance, and accidents are almost sure to occur. The second measure taken to reduce the number of accidents in the power press department of this company is the provision of a set of rules and regulations which is attached to every machine. These rules, which are shown in Fig. 1, are lithographed on a metal plate and attached to the presses, regardless of whether they are furnished with fool-proof guards or not.

RULES FOR THE OPERATION OF THIS PRESS

1
Belt must be on loose pulley when setting dies.

2
After die-setter has finished setting press, clutch lever must be in locked position with latch provided for same.

3
In no case shall a die-setter or operator polish a die or punch or adjust gages without first throwing in safety latch, throwing air handles backward and placing a piece of wood not less than 4 inches square between the punch and die.

4
When peening the cutting edge of a die or punch, the belt must be on the loose pulley to allow shearing in by hand.

5
A die-setter or operator must not operate a press unless the machine and safety device are in perfect working order. The foreman in charge must be immediately notified if anything is wrong and work on that press must not be resumed until press and safety appliance have been restored to perfect order.

6
Anyone failing to follow these rules will be discharged.

Fig. 1. Rules contained on Lithographed Plate which is attached to Power Presses

Double Arm Gate Guard

The guard shown in Fig. 2 is attached to a number of Bliss No. 21 inclinable presses, and is so constructed that it covers the full width of the bolster plate and allows no opening through which the operator can extend his hands immediately before the press ram descends. The mechanism which operates this gate is so synchronized with the operation of the power press clutch that as the treadle is depressed the gate descends to a given point before the clutch is released. If the operator's hand happens to be under the punch at the time, the operating mechanism of the clutch cannot operate until his hand is removed and the gate permitted to swing downward to a given point.

The operating mechanism of this type of guard is clearly illustrated in Fig. 3. This is a side view of the upper part of the power press with the driving pulley removed. When the foot-treadle is depressed, the treadle-rod A swings the gate arms B downward until the arms engage the lower end of the eye in latch-rod F. This pulls the latch E from engagement with the clutch dog and permits the press to trip. Before the latch E is fully disengaged, however, the dwell-arm D, which travels down with the arms B, becomes engaged with the dwell bracket G, aided by the tension exerted by spring K. By the time that the latch E has been completely disengaged, the gate has traveled downward about 1½ inches from the position occupied when arm D is first engaged with bracket G.

Upon the release of the treadle, dwell-arm D again becomes engaged with bracket G, due to the tension exerted by spring C, thus preventing the raising of the gate while latch E is disengaged and the clutch of the machine in operation. There is a cam H attached to the crankshaft of the machine for the purpose of releasing dwell-arm D and permitting the gate to be pulled up, and this cam is so adjusted on the shaft that the raising of the gate does

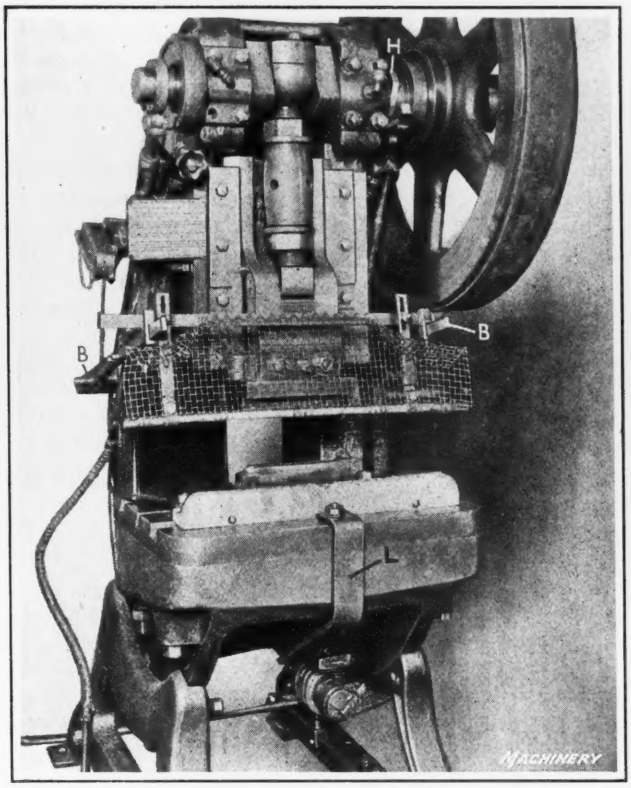


Fig. 2. Power Press with Swinging Gate Guard

not occur until after the ram of the machine is on its upward stroke. The 1½-inch rise of the gate which occurs when the treadle is released, and which is limited by the engagement of dwell-arm *D* with bracket *G*, brings the bottom of the gate to the top of a wooden guard, which is shown attached to the bolster of the machine in Fig. 2. This provision makes it impossible for the operator to reach into the die just as the press is about to be tripped. The operator might have such an impulse if he found that the blank was improperly placed in the die, but by simply releasing the dwell arm *D* from engagement with bracket *G*, by hand, the gate will rise and the latch be brought into position for preventing the tripping of the press. This is made possible by having the mechanism so arranged that when the dwell-arm is engaged the latch will be only partly disengaged, enabling it to be returned to engagement with the dog before the press trips.

The latch-rod is made in two parts with a connection, and there is a casing *J* which encloses this connection, so that in case the latch-rod breaks or the threads strip in the connection, the two parts of the latch-rod will be held together and latch *E* will always be moved in a direction to stop the operation of the press, but it will be impossible to start the press again until the latch-rod has been repaired. Should the spring *C* break, the gate will drop, but if there is anything extending in from the front of the machine over the wooden guard attached to the bolster, the gate will not be able to drop sufficiently to cause the clutch which operates the tripping of the press to become operative. Thus, even if the operator's hands were in the die it would be impossible for the press to trip in case the gate should accidentally drop. The design of the arms *B* at that portion which operates in the eye of the latch-rod *F*, is such that when these arms are depressed, the entire length of the slot will be filled, thus forming a solid connection to the latch-rod. By this construction there is no lost motion of the arms in the eye, so that when the treadle of the machine is released the latch-rod will be positively returned to its upward position. If, however, the latch failed to return to the position which would stop the press, the machine would continue to operate, but the gate could not rise because the design of arms *B* is such as to prevent this until the arms have swung clear of the upper end of the slot in the latch-rod. This cannot occur until the latch-rod is in its upper position. A sheet-metal guard is attached, as shown, to protect the extending arms against injury from trucks, etc., which might occur in case the press should be located near an open aisle.

Eliminating Injury Due to Machine Breakage

This power press is also furnished with a shin guard *L*, Fig. 2, consisting simply of a piece of strap iron attached to the bolster of the machine, as shown, and extending under it to support the spring or rubber cushion, as the case may be. This prevents the cushion from falling down in case the bolt, by means of which these buffers are attached to the machine, should break. Often serious injury may result from this cause.

On the heavier types of power presses there is always the liability of the pitman screws breaking, permitting the ram to drop on the operator's hands. Numerous accidents of this kind have occurred, but they may be entirely eliminated by the simple provision of an auxiliary emergency supporting means. In Fig. 4, which shows a No. 31½ Bliss geared press, this precaution is taken by attaching a chain to the ram, both at the front and the rear, connected by a wire cable and hook, so that the length of the chains may be changed when it is desired to adjust the pitman screws. It will be seen that this machine is also provided with a swinging gate guard of the type used on the machine shown in Fig. 2.

This guard is similar in construction to the guard previously described, except that the dog with which the clutch-release latch engages also acts as a cam for the dwell-arm, engaging the upper end of the arm by a bevel or cam surface on the side of the dog. The arm has a notch in its lower end, instead of an eye as in the other design, and this notch engages the gate arm, holding the gate down until the cam surface on the side of the dog knocks the arm to one side, thus permitting the gate to swing up. This release is timed to occur after the ram has started to ascend, similarly to the synchronization of the gate and tripping movements described in connection with the No. 21 press.

The design calls for a somewhat different arrangement of the working parts than that shown in Fig. 3, but the method

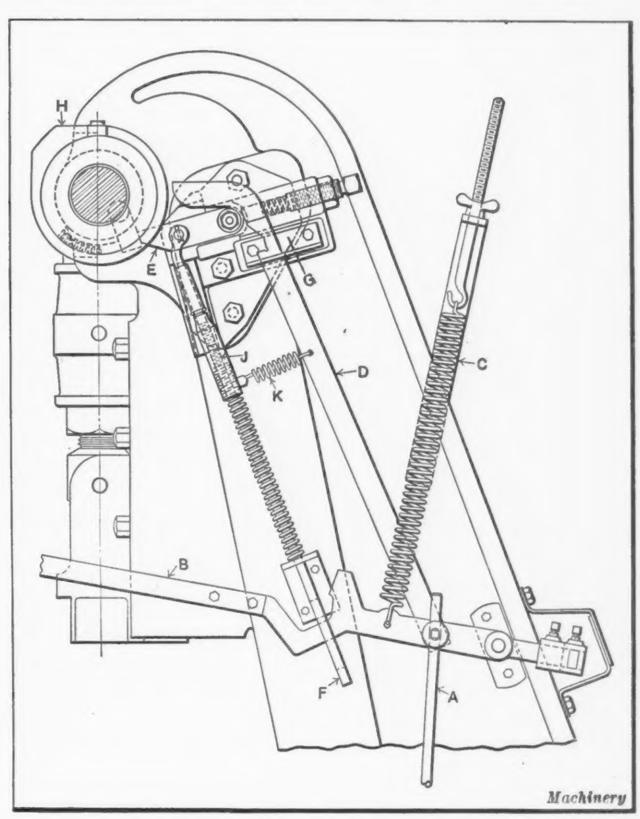


Fig. 3. Mechanism for actuating Swinging Gate Guard of Type shown in Fig. 2

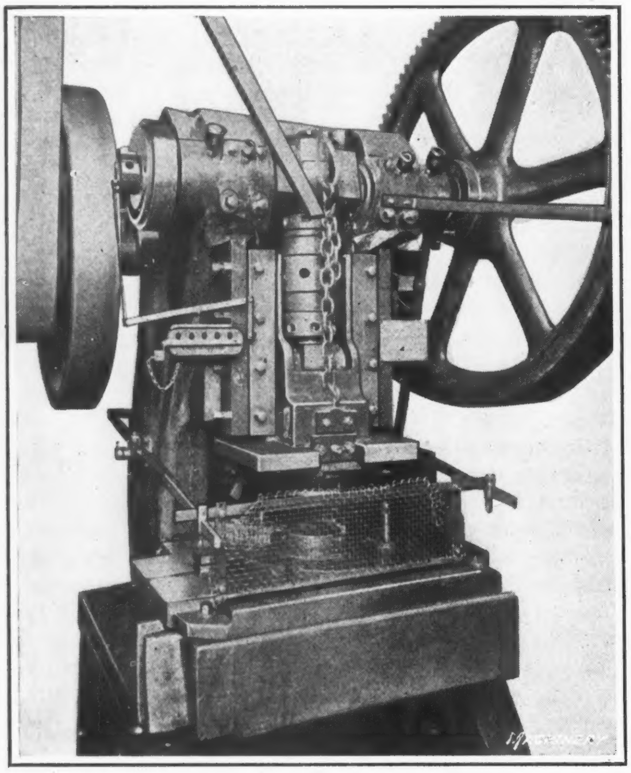


Fig. 4. Press with Emergency Support for the Ram in Case the Pitman Screws break

of operation is substantially the same. The spring for raising the gate when released, for example, instead of being placed above the arm, is attached to the base of the press at the rear, and is connected to the extending end of the gate arm, the upward movement of the gate being stopped by a suitably located rubber buffer against which the arm strikes. The detailed construction of this, as well as of all other devices here described, will be furnished to those interested in using them in their own shops, but not for commercial use.

An auxiliary support for the ram may also be provided in the manner indicated in Fig. 5. This is a smaller press than the one shown in Fig. 4 so that a support of the kind shown is fully adequate. It consists simply of a strap *A* attached to the center bearing of the crankshaft and twisted so as to be fastened to the side of the ram. Provision is made for adjusting the barrel on the pitman screws by an elongated slot for the clamping bolt *B* and a toothed construction where the strap is attached, so that it may be securely clamped by the use of but one bolt. This is the same type of machine shown in Fig. 2 with the gate guard removed.

Air-operated Drop Gate Guard

An interesting design of gate guard is shown attached to a No. 354 Bliss double-action press in Fig. 6, while a completely assembled view of the guard and its operating mechanism is illustrated in Fig. 7. This is an air-operated guard, with an interesting application of compressed air for operating the press. In operating the machine, it is necessary that both the workman's hands be used, but if for any reason the press should repeat or operate without the application of air (in which case the operator's hand might be under the ram), the gate is automatically released and falls down on the workman's hand, thereby warning the operator that the press is repeating. The blow caused by the falling gate is not severe enough to injure the hand. The operation of the controlling mechanism of the guard may be clearly understood by referring to the two illustrations in connection with the following description.

The air line is shown at *A*, and the direction in which the air flows is indicated by arrows in Fig. 7. As soon as the two air valves are opened, requiring the use of both hands, the air is permitted to flow until it reaches the air gun *B*. Plunger *C* is then forced out until it operates the lever *D*, which is attached to the cross-shaft *E*. This results in turning the shaft to which the fingers *F* are also fastened, disengaging the lugs *G* which are a part of the gate slides *H*, and permitting the gate to drop.

The gate has now dropped, but the press does not operate until the plunger *C* has been forced out, permitting the air to pass downward from air gun *B* and enter the air gun *J*, which controls the release of the press-operating clutch. The construction of this gun is similar to that of gun *B*, and when the plunger is forced upward it operates against lever *K*, releasing latch *L* by means of a connecting-rod and a series of levers. The releasing of latch *L* permits the lifting rod *M* to drop, thus engaging the clutch of the machine and causing the ram to descend. The gate is automatically raised with the ascent of the ram by any suitable mechanism connecting shaft *E* with the throw of the crank, which will result in turning this shaft and hooking the fingers *F* under lugs *G* of each gate slide. The method of producing this movement is somewhat different in the machine shown in Fig. 6 from that shown in Fig. 7, but the results are the same. In fact, any means by which the throw of the crank can be utilized is suitable. Two coil springs on shaft *E* hold fingers *F* in engagement with lugs *G* until the shaft *E* is again turned.

If the press should operate without air, that is, if it should repeat, the gate will be dropped before this movement can be completed. There is a pawl which may engage lug *N* on the left-hand finger *F*. Should the gate be lowered with the accidental descent of the ram, this action would disengage fingers *F* from lugs *G* and permit the gate to drop suddenly on the operator's hands. Spring buffers *O* are provided to absorb the shock of the falling gate on the bolster

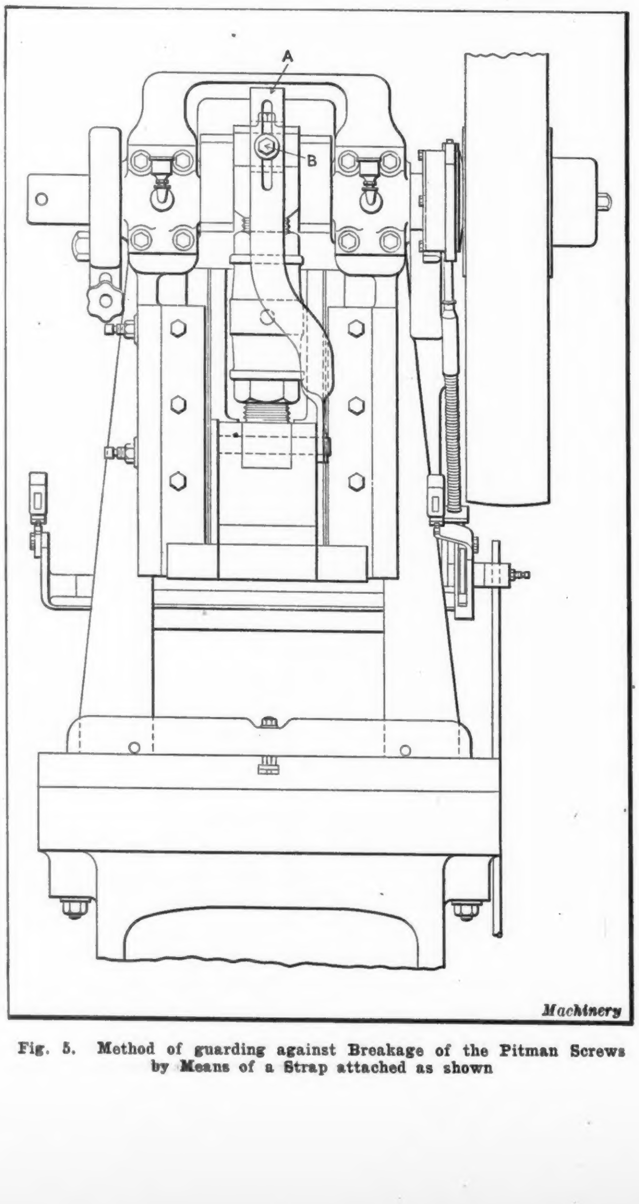


Fig. 5. Method of guarding against Breakage of the Pitman Screws by Means of a Strap attached as shown

plate. The gate is so constructed that it can swing outward on swivels *P*, so that the operator may easily withdraw his hands, but the guard cannot swing in toward the dies. The upper brackets through which the side-rods on which this gate operates extend have the holes in them liberally countersunk on both sides, so that by removing the knurled nuts *R* the device may be swung forward and readily removed from the press, should it be desired to do so. It will be noticed that there is an oil-cup in the line so that the air guns may be lubricated with atomized oil from time to time, as required.

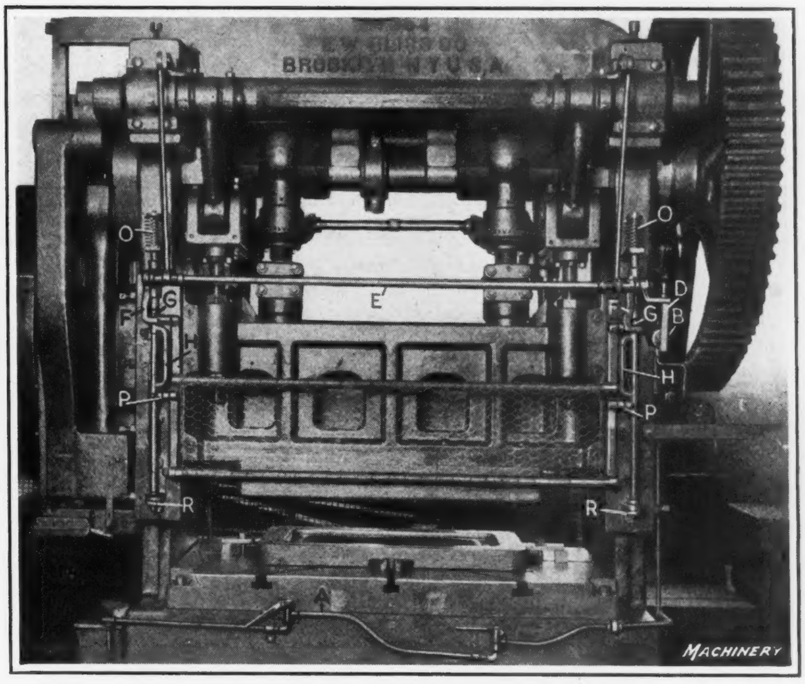


Fig. 6. Double-action Geared Press with Air-operated Drop Gate Type of Guard

Mechanically Operated Drop Gate Guard

In another design of drop gate applied to a No. 5½ Bliss power press, a somewhat modified application of this guard is made. In this design, instead of using an air gun to release the gate, the latter is designed to hang below the level of the die and to be raised by a series of levers actuated by the crank throw of the power press. In this arrangement, air is used to trip the press, the air line being identical in arrangement with that shown in Figs. 6 and 7 except that the gun shown at *B* is not required. When the ram of the press is in its raised position, the gate is down and the connections by means of which the gate is raised are designed to operate as the ram descends, thus acting as a safety device by pushing the operator's arms away from the die; conversely, with the ascent of the ram the gate is again lowered. The gate is made in two pieces, the top part being adjustable to bring it level with the top of the die when the gate is lowered, which, of course, requires adjustment according to the height of the die.

In the next article, which will appear in September MACHINERY, additional types of gate guards will be shown, including guards of the sweeping type, sliding guards, stationary guards, and guards for shears.

* * *

The exports of steam locomotives from the United States, according to a recent Commerce Report, increased from 491, valued at $4,475,429 in 1913—the last pre-war year—to 959, valued at $30,275,728 in 1919—the first peace year—and to 1711 in number valued at $53,629,847 in 1920.

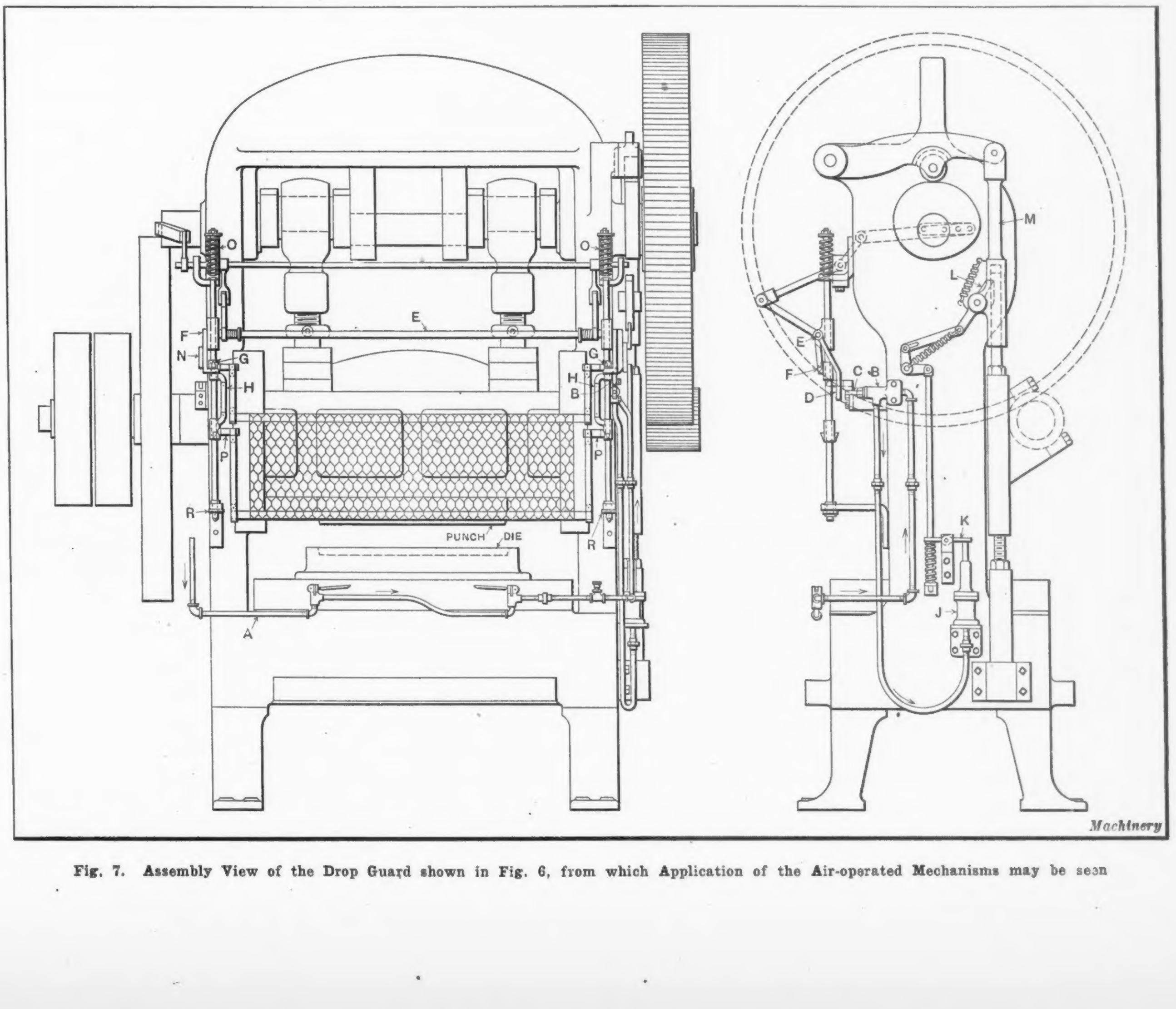


Fig. 7. Assembly View of the Drop Guard shown in Fig. 6, from which Application of the Air-operated Mechanisms may be seen

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TIDING MEN OVER A DEPRESSION

Manufacturers in Springfield, Mass., prominent among whom are the builders of the Indian motorcycle, have adopted a plan to mitigate the hardships of unemployment among their men during the present depression. The plan, which is in operation in nearly a score of plants in that city, is this: Instead of complete and continuous employment for many, and continuous unemployment for others, the men alternate in the different jobs, on the principle that it is better for two men to be working part time than for one to be employed continuously while the other is idle continuously. In this way the pinch of hard times is made less severe for a great many, and in the motorcycle plant mentioned it has been found that this rotation of men in the different jobs from week to week adds nothing to the cost of production, nor does it affect the steady flow of the product through the plant.

This method of providing part-time employment for the greatest possible number of men would differ in detail in every shop; but if it is desired to give a maximum number of men some wages for the time being, instead of none at all for many, the plan, adapted to suit the conditions peculiar to any shop, will be found practicable.

In cases where the work is of a highly specialized nature, requiring unusual skill or long training, it would not be practicable to alternate, except where a considerable number of such skilled men were unemployed, but for ordinary production work, where the employe is mainly an operator, there should be no great difficulties to overcome. The method has the further advantage of keeping the desirable men employed and at hand, so that when business starts up again, a regular working force is available, and production can be increased as desired without the necessity of finding and training green help—which is always expensive.

* * *

STANDARDIZATION OF MACHINE TOOLS

The development of machine tools has not yet reached the point where a consistent policy of standardization can be adopted, but we should look forward to the time when a considerable number of the different types and sizes that are now built can be abandoned, and when the designing of machine tools will reach a point where increased efficiency cannot readily be obtained by making changes from year to year. Some time ago a manufacturer of drilling machines stated that, taking into consideration all the types and sizes differing in some detail from the standard type, his firm had made about three hundred different kinds of machines. The same is true in a lesser degree of other machine tools.

Some day it may become possible to standardize machine tools so that they can be built in large quantities by interchangeable manufacturing methods, much the same as automobiles are now made, and under such production conditions both the manufacturer and the buyer would share in the advantages gained. It would be cheaper to manufacture machine tools in that way, the cost of the original design and the experiments which must always be made in developing new models being distributed over a large number of machines, so that the purchaser would obtain tools at a lower price and the manufacturer would obtain greater returns for the ingenuity and labor put into the machines.

Such standardization is not possible in the immediate future, because there are still so many improvements to be made in machine tools that any attempt at a complete standardization of types at the present time would be impracticable. But just as electric motors and automobile engines have been so nearly standardized that hundreds of thousands are built without change and the designs remain practically the same for years, so it is conceivable that some day machine tools will have developed to a point where the best possible features will be incorporated into machines which may remain the standards for years and which could then be produced in large quantities.

It is also likely that in the future there will be still further specialization among manufacturers, so that one manufacturer can concentrate not only upon one line of machines, but possibly upon certain types of that line. In that way costs would be decreased and the heavy burden now carried by the machine tool industry for development work—which is sometimes duplicated in half a dozen shops simultaneously—would be avoided.

While some of these developments are in the distant future, there are many present possibilities for standardization in minor details entering into the design of machine tools, such as spindle noses, toolposts, T-slots in tables, keyways, etc. Much would be gained, for example, if chucks of similar size were interchangeable between all the lathes in a shop, and if all spindles would take collets of the same kind.

* * *

ORDERING REPAIR PARTS

While modern machine tools are so heavily constructed that breakages occur less frequently than formerly, certain parts are subjected to such heavy wear and excessive stresses—and sometimes to abuse by careless or incompetent operators—that sooner or later it becomes necessary to replace them. Then it often happens that the machine remains idle much longer than necessary because proper care is not taken in ordering replacement parts. Machine tool builders frequently receive letters asking to have certain parts replaced, but the names given to the parts are entirely different from those given by the maker, and the description or specification is so inadequate that it is not possible to determine exactly what parts are required.

In their carefully prepared catalogues, machine tool builders generally give specific directions for the ordering of repair parts, in order to save their customers mistakes and delays. In the absence of such directions, a machine tool user ought to make a simple drawing of the part required, giving the important dimensions. In that case it would be easy for the manufacturer to identify the part and to ship exactly what is needed.

Another mistake often made when breakdowns occur, is to merely order a repair part, letting the machine stand idle until it arrives, instead of having a competent mechanic examine the machine at once to see whether some simple repairs might not keep it running for a few weeks while waiting for the required part. The more highly specialized a plant is, the more likely it is that machines stand idle when breakages occur, until the broken parts have been replaced by new ones of exactly the same kind and type as those that failed. In the smaller shop—generally less highly organized—troubles of this kind are usually carefully looked into by a foreman or the superintendent himself, and in that case some makeshift remedy is promptly applied and the machine keeps on producing until more permanent repairs can be made.

The Present Situation and the Outlook

More Letters on Today's Problems from Practical Business Men

KEEPING EVERLASTINGLY AT IT

By F. H. MOSES, President and General Manager, Adriance Machine Works, Inc., Brooklyn, N. Y.

The condition of the industrial world today may be likened to the condition of a patient in a very low state; a stimulant is clearly needed. The great purchasing public, including the manufacturer, must be stimulated to buy. The starting of one cog, whether by the public in general or by the manufacturer in particular, must necessarily involve action in all the others. Every order placed now, every additional employe placed on the payroll, means that we are approaching so much nearer to a solution of the industrial problem.

Our own efforts have been concentrated in an endeavor to stimulate trade by various methods of direct and indirect advertising. In one branch of our industry we are making an appeal directly to the public without directly referring to our own product, believing that what is for the benefit of one must necessarily be for the benefit of all. In other lines, we are sending out demonstrating units, mounted on trucks, prepared to give a practical working demonstration to the man at the door of his plant. This we have found to be an appeal that decidedly stimulates interest, and it has brought orders even from sections of the country where lethargic conditions prevail.

The foregoing plan is, of course, not adapted to the selling of heavy machinery which makes up a large part of our line, but we have found by extending our service, by following up, as far as possible, all inquiries with a personal call —in other words by injecting the necessary stimulant or stimulus into business, we already see signs of resuscitation in that very live corpse—American Industry.

In the timely letters of constructive thought and business advice published last month, representative men in the machine tool field expressed themselves on many of the industrial problems of today, with the definiteness characteristic of the practical business man. A number of additional letters are published this month, dealing with such important subjects as standardization, the need for up-to-date equipment, publicity and advertising, and many other problems that demand careful consideration. An exchange of ideas is the most valuable form of cooperation at this time.

STANDARDIZATION A VITAL FACTOR

By E. J. SKINNER, General Manager, Skinner Chuck Co., New Britain, Conn.

Our attitude toward the future is that we can look forward to good business again in the machine tool and supply line. We are manufacturing our product for stock with an idea of giving the best service possible to our customers when they shall be in need of our products.

It seems to the writer that the dominant thought of today should be that now is the time for standardizing machine shop equipment. What a decided advantage it would be if all electric drill manufacturers used the same size and kind of fittings for attaching chucks of like capacity, for example, instead of some using a taper arbor and others a threaded spindle.

What a great improvement it would be if all drill chucks of like capacity had the same size recess to receive an arbor. This would relieve the dealers from carrying in stock such a variety of arbors and would enable the manufacturers to produce arbors in such quantities that they could be sold at a lower price.

We are considering problems of this kind during the summer dullness, together with labor problems and greater efficiency in manufacturing. The manufacturer who makes a product of superior quality and is prepared to give service is going to reap a reward with the revival of business that is sure to come, but we do not consider ourselves able to predict the date of its coming. However, we mean to be ready when the time arrives.

THE INFLUENCE OF FEAR IN BUSINESS READJUSTMENT

By F. O. HOAGLAND, General Manager, Reed-Prentice Co., Becker Milling Machine Co., and Whitcomb-Blaisdell Machine Tool Co., Worcester, Mass.

[Owing to a typographical error, a paragraph in Mr. Hoagland's letter published last month became unintelligible, and the force of his statement was impaired. His letter is therefore republished this month.—EDITOR]

Eliminating all the causes of the present business depression which have previously been brought up, such as the war, the labor situation, overproduction, banking facilities, etc., my opinion is that the real reason is plain *fear*. There is a lack of confidence between individual men, between classes, between the people at large and the administration, and also between nations, and one *fears* what the other is going to do next.

If a man does not have more than one dollar and he does not see where the next one is coming from, he is very apt to hesitate about spending it; he may call it waiting for prices on labor and material to come down or what not, but the fundamental basis is that he is *afraid* to invest or spend his money, because he does not have full confidence in the man he is dealing with, and the only remedy I know for this is *time*.

After a great loss, whether it is a member of your family or part of your savings, you feel it very keenly immediately after it happens, and for some time afterward; but after awhile it will wear off and the pangs are felt less keenly—you gather yourself together, and proceeding with caution you are soon back to your old strides again.

I know of specific cases where money is available for purchasing commodities, but the decision to buy is being delayed, waiting for prices to come down, sufficient confidence not being placed in the seller's statement that prices have reached rock bottom—*fear* again of having to pay a higher price than the goods may be bought for later.

The machine tool industry is, as usual, the last to be affected by the return of good times, and unless the machine tool builders can devise improved machines for manufacturing purposes which would plainly prove to the user that even with the present limited production he cannot afford to get along without them, it is apt to be some time yet before conditions in the machine tool industry will be normal.

When a man is under the influence of *fear*, his brain does not function normally and his planning ability is affected; this is a sufficient reason for ours not working to the best advantage at present.

IMPORTANCE OF STANDARDIZATION

By W. E. MOORE, President, W. E. Moore & Co., Engineers, Pittsburg, Pa.

We believe the outstanding feature of the present machinery trade situation is the vital necessity for radical cost reductions. Germany is rapidly getting in shape to export machinery at very much lower prices than are now being quoted here.

We, of course, have to maintain quality, but it is absolutely essential to standardize the parts of our products and systematize and concentrate production in such a way as would tend toward the maximum economy in production and sale costs. As an instance of this, we might mention that there are more than a dozen manufacturers of dividing heads or index-centers for standard milling machines, each manufacturer making one to four models and making these in small quantities. A centralized manufacturing concern for index-centers could, by concentrating on three or four models, turn these out in standardized form to suit all manufacturers, and could not only make them in more perfect detail, but also market them at very much reduced prices. This standardization would not only help the manufacturers of milling machines to cut their costs, but would be a vast economy to the users of milling machines as well.

There is another matter that has long needed attention—why should we have two different standards for taper centers for machine tool tapers, namely, the Morse taper and the B. & S. taper? It surely seems that these two sizes should be merged into one with merely the modification of tang tops where required. This would cut out a multiplicity of standardized small tools and a variety of adapters, etc., which are necessary in machine shops.

It is most important that manufacturers get together and standardize milling machine and lathe spindle noses. This is causing a vast amount of complication in machine tool manufacture and still more to the users of machine tools. It seems most important that American manufacturers get together on such basic matters for standardization, in order to get on the most efficient basis for meeting competition.

ADVERTISING AS A FACTOR IN BUSINESS RESTORATION

By GEORGE WILFRED WRIGHT, Newark, N. J.

Manufacturers of machine tools and allied products no longer have to be urged to employ advertising as a selling factor for enlarging their market. The question at issue is: How can the appropriation be made to yield the greatest results, and what can be done with the power of advertising to help bring about better selling conditions right now?

It may be unnecessary to state that the way to keep up industrial depression and to thicken the gloom-pervading atmosphere is to curtail the advertising budget and turn down every helpful plan that is presented as an aid to stimulate business. And it is not saying too much to assert that this is exactly what has been done by a number of manufacturers within the last year. The very last asset a business man can dispense with, in these times of restoration, is his advertising program, provided he has one based on a thoroughly safe and well defined line of action.

The business and trade magazines of today furnish a vast fund of information for the advertiser. Research bureaus are established where both foreign and domestic market reports, together with the various leading publications covering those markets, and the best means of directing advertising therein are carefully analyzed and arranged in an intelligent manner, in order that the advertiser may have a well organized plan when he launches a campaign to expand his business.

How many merchants and manufacturers know that nine hundred million dollars worth of merchandise has been sold by the Government to private concerns through advertising alone, during the last fourteen months? And this was done on an appropriation of less than $640,000 or less than one quarter of one per cent. And sixty-five per cent of this appropriation was spent in trade and business magazines. If this great object could be carried out so successfully through a dull, flat, lifeless business period, why do some manufacturers let up on their efforts and say: "There is no use, we've got to wait until things take a turn."? Why wait until things turn? Why not go out and turn them yourself? Why not perfect the product and get it entirely ready to market? Why not make a new study of the market—study it from all angles, instead of one? Why not make a closer study of advertising as applied to sales, and determine to link it up closer with the sales organization and then select the publication that will reach the most desirable fields? Last but not least: Why not secure the services of those men who are working in the field, and who know the various phases of advertising, even more accurately than the advertiser himself?

The most progressive and successful concerns are working out their problems on this basis, and the coming year promises a forward stride in the machine tool field. It behooves the smaller manufacturer to use advertising to the utmost limit in the trade publications, and to follow up his inquiries carefully. The time to treat the publicity matter as a side issue is past; and with a clear conception of the obstacles to be overcome, the results will more than justify the expenditure.

RESTORING CONFIDENCE IN THE FUTURE

By R. K. CHENEY, Sales Manager, Tolhurst Machine Works, Troy, N. Y.

The underlying fundamentals of this world-wide business depression have been discussed by the greatest intellects of both continents. We are all somewhat familiar with the generalities of international finance and know that the foreign public and private indebtedness to these United States amounts to about eighteen billion dollars. It has been pointed out to us that our products are today in excess of our maximum consumption and that if we are to utilize our enlarged production, we must depend upon the foreign absorptive power. This, of course, is limited by the present condition of international finances.

We have more intimate knowledge of our federal and state taxes and know the burdens placed by them upon American manufacturers. It appears that the Budget Bureau of the Treasury Department and the possibility of an international agreement concerning disarmament may mean such a curtailment of federal expenses that we shall know an alleviation of this handicap.

There are two factors contributing to our present condition which we may try to improve upon:

The limitation of output imposed by labor is a very serious drag upon industry. It may be rectified by many processes or combination of processes, but probably the road of least resistance and of most permanent results is through a closer personal relationship between employer and employe. When the employe can be made to realize that his interest in the business is as real as that of the employer, but only smaller in quantity, then will he appreciate that normal production rather than curtailed output is to his personal advantage.

To my mind a most important factor is the morale of business. Many times each day we are informed that "there isn't any business." We read it—the salesmen calling on us preface their remarks by saying they are on a missionary trip and do not expect to sell us, while our own salesmen write letter after letter to the same effect. We are working in a groove if we believe that there are no buyers left.

The only solution is for each and everyone to realize that we must replace our own obsolete equipment, repair where we can, and install such other equipment as may be necessary to cut our manufacturing costs. When we can lift ourselves out of our present groove and make our salesmen

realize that there is a need for machine tools and that we are here to sell equipment—not the services of a missionary—then we shall see business return to a normal basis.

Do not forget that the textile industry of this country was about as hard hit as any, and yet today it has recovered and some branches are running night and day; the average is about 75 per cent of normal operation. There are orders waiting for the man who has confidence in the machine tool industry.

NECESSITY OF LOW PRODUCTION COSTS

By B. L. CALKINS, Sales Engineer, Peerless Machine Co., Racine, Wis.

Our opinion is that cost-cutting machinery and methods must be installed in both the large and small shops of all industries in order that low production costs all along the line, together with lowered freight rates, will permit of normal first costs, normal sales prices, and normal profits.

UP-TO-DATE EQUIPMENT WILL BE NEEDED

By EDMUND J. HENKE
President, American Electric Fusion Corporation, Chicago, Ill.

I have just returned from a trip through most of the states east of Chicago, and though I have brought home not a single order, I have plunged into work with a new vigor, because of the things I have seen and talked about with various shop executives. They all realize that though labor costs will come down some, they will never be back to the pre-war level. Thus, labor being the most important and expensive item, it must be saved and utilized with least waste; and there is only one thing that will do it—that is, modern up-to-date production machinery. They all know it, and as soon as there will be some general business in sight, the machinery business will come back with a vigor and snap not hoped for even in our most daring dreams in these times of depression.

The machine tool business is but an auxiliary branch, doing its part to produce the necessities of life. The demand for these necessities has been greatly curtailed through the lost confidence of the buying public in the stability of prices. They all look for the bottom to drop out of everything, but instead of that liquidation comes in driblets and each drop shakes the confidence more; this process will continue until most of us will see that by waiting to buy to save $100 we are losing $1000 by remaining idle. The demand in the machine industry in the meantime is nil.

During the last few years almost anything that would work and could be delivered promptly could be sold. We had no time to think of how to improve our product, and the buyer had to put up with many grievances. But now the buyer will take his time to make a careful choice and the best will win. My advice is: Improve your product as much as you can. Tool up so as to produce it efficiently, to be able to sell it in a stiff competition at a fair profit.

Advertise and let people know what you have. And do it now, when they all have time to read your message, which if brought out efficiently will stick in the minds of those that buy your product. Do not do it with a splurge and then quit; you may quit just at the time when the man that wants your product has made up his mind to buy. You will lose then, because he will not be able to find your message in the current number, and surely you would not expect him to go through a stack of magazines hunting for your advertisement. Do not expect a stack of orders because of a single advertisement. Miracles may happen, but the buying of machinery is not done whimsically, because a man likes your advertising. He will remember you, but will buy when he needs your product, and then it's up to you to make it easy for him to find you.

Above all prepare now for better business and prompt deliveries, for when business returns everyone will be wanting deliveries day before yesterday.

BELGIAN MACHINE TOOL TRADE

A recent report from Acting Commercial Attaché Samuel H. Cross, Brussels, reviews the situation in the Belgian machine tool industry and market. There are only four important Belgian plants manufacturing machine tools—two located in Brussels and one each in Liége and Bruges. One of the Brussels plants specializes on lathes from 14 to 40 inches swing; while the other, having a capacity for building from 1000 to 1200 machines a year, builds lathes, shapers, and hammers for forge shops. The Bruges plant builds several sizes of boring mills which have acquired a good reputation.

The principal export markets for Belgian machine tools are France, England, and Italy. The prices are generally from one-third to one-half of those at present asked for American tools in Belgium. For instance, a plant in Liége turns out a wheel lathe selling for one-third the price of a well-known American make, but the lathe has not anywhere nearly the capacity of the American competitor, because it weighs only one-third as much as the American machine, and hence would never compare with it in production work. Belgian machine tool builders have frequently imitated American machines, and one case is noted where an imitation of a small American drilling machine sells for 650 francs in comparison with 1200 francs asked for the American make.

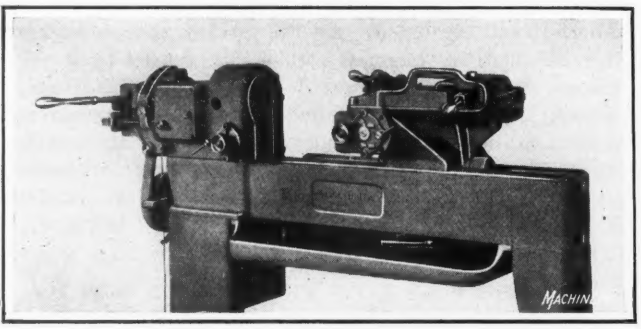
According to local machine tool dealers, before the war 70 per cent of all machine tools imported into Belgium were of German origin. For reconstruction purposes after the armistice, however, American machine tools were sold in Belgium in large quantities; the United States War Department alone disposed of $3,500,000 worth of tools through the cooperative body known as the Construction Metallique, and it is estimated that fully as large a sum was spent in purchasing machines privately. Later, German machines reentered the field at relatively low prices. While it is generally recognized by Belgian machine tool users that the German product is not of the same high quality as the American product, the present exchange rates and the lower German prices are strongly in favor of the German machines. Several agents for American machine tools who carried large stocks suffered severe losses during the latter part of 1920, and at least one of these agents was forced, by economic conditions, to take an agency for German machines. Except in this one case, the sale of German machine tools is in the hands of relatively small and unimportant commission houses, whose methods render competition difficult at the moment.

In the small tool and accessory field, there are greater possibilities for American products at the present time than in the machine tool field. Grinding wheels and small tools sell with comparative ease, although the market is practically closed to American twist drills, English and German firms offering active competition. A 1½-inch carbon steel drill is offered in Brussels by German firms for 6.25 francs in comparison with 35.15 francs asked for a well-known American drill of the same size. German prices on micrometers make it possible for them to hold the market in these tools much the same as in drills. A German product, not of very high finish but of entirely accurate construction, is sold in Brussels for 31.20 francs, while the price asked for the corresponding American micrometer is 96 francs. German competition is particularly active in measuring tools. German tools of this kind placed on the local market in Belgium bear no mark indicating their origin but the German manufacturer will stamp, upon request, the name and address of the dealer free of charge.

* * *

According to a recent Commerce Report, the prohibition on the importation of American passenger automobiles into Italy has been removed.

Hanson-Whitney Centering Machine



SUBSEQUENT operations, such as grinding, or the milling of a worm, on large numbers of parts produced from bar stock in turret lathes and automatic screw machines can frequently be best performed when the work is supported on centers. In order to provide accurate centers on work of the type mentioned, the Hanson-Whitney Machine Co., Hartford, Conn., has developed the machine shown in the accompanying illustrations.

In this machine, the work is rotated during the centering operation, the left-hand end being driven by a chuck in the work-head, while the right-hand end is supported in a steadyrest. By this arrangement the same degree of accuracy is obtained as when the operation is performed in a lathe provided with a steadyrest. The machine, therefore, should increase the field of usefulness of turret lathes and automatic screw machines, because it makes it practicable to handle parts on these machines which otherwise it would often be considered necessary to machine while supported on centers during every operation, in order to obtain the required accuracy. The machine is also equally well adapted for rough parts.

The various units are mounted on a bed amply proportioned and equipped with a pan of generous dimensions for catching chips and lubricant. The regular bed accommodates work up to 24 inches in length, but longer beds can be furnished to meet practically any requirement. The work-head is a stationary unit provided with a tight and loose pulley drive so that the machine may be driven directly from a lineshaft. The spindle is mounted on ball bearings; in addition to the advantages usually gained by this construction, this enables the starting and stopping of the spindle to be sensitively controlled. An accurate and substantial chuck is used for driving the work, and this is built into the work-head as a component part. It accommodates work ranging from 3/8 to 3 3/16 inches in diameter, and any size within its capacity can instantly be gripped with a uniform pressure, which is obtainable without adjustment of any kind. The lever that controls the opening and closing of the chuck is so located that it can be easily manipulated from the working position of the operator.

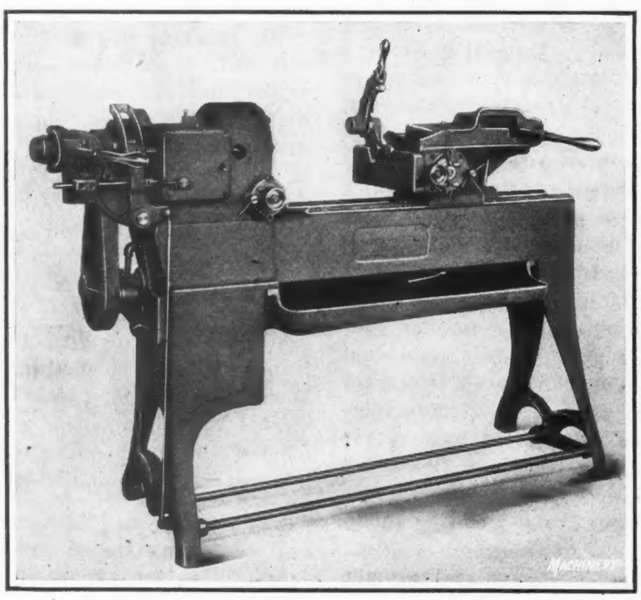
The belt-shifting mechanism is semi-automatic in operation. A rod mounted on the bottom portions of the legs and extending the entire length of the bed, serves as a foot-treadle, and by its operation the belt is shifted to the driving pulley. When the chuck is opened to release the work, the belt is automatically returned to the loose pulley and an automatic brake almost instantly stops the spindle from rotating. An adjustable V-rest is located in the front section of the work-head for supporting the work as it is advanced into the chuck. In setting this rest for work of a given diameter, the latter is first gripped in the chuck and then the rest is elevated by rotating a knob on the side of the head. The clamping action is such that the rest automatically recedes 1/64 inch to provide proper clearance for the work.

The steadyrest is of an improved roller type, having two rollers in the lower member and one in the swinging member. The two lower rollers can be adjusted to suit different diameters, the movement of both rollers during the adjustment being controlled simultaneously through a dial indicating device having both English and metric graduations. The upper roller can be swung into the proper position regardless of the diameter of the work.

Two tools are provided on the machine for producing centers, the first being a combination drill and reamer which is used to drill and rough-ream the center, while the second is a "one-half" type center reamer which takes a finishing shaving cut. The tool carriage has two tool-holders which are rectangular in cross-section and mounted in a bracket that can be oscillated for positioning the cutters. Provision is made so that the tool-holders can be conveniently centralized if this should be necessary. The longitudinal travel of both tool-holders is controlled through one lever, a locking device forming part of the construction, so that both tool-holders must be in the neutral position before it is possible to swing the bracket for engaging either tool. This design prevents the tools from becoming injured through faulty manipulation.

Stops control the depth of the center from the end of the work, thus insuring a uniform depth irrespective of variations in length. The tool carriage is adjustable longitudinally on the bed to accommodate parts of various lengths. The machine is equipped with a pump for supplying lubricant to the cutting tools, the lubricant being conveyed through the tool-holders directly to the tools. This arrangement has been found to work out well. A tank is cast integral with the left-hand legs of the machine and the pump is mounted directly over this tank.

The operation of the machine is as follows: The operator locates the work-carriage longitudinally, sets the lower steadyrest rollers to suit the work diameter, grips one end of the work in the chuck, swings the upper steadyrest roller into position, elevates the guide rest until it comes into contact with the work, binds this rest, and starts the machine by depressing the foot-treadle, the machine being stopped when the chuck is opened.



Centering Machine built by the Hanson-Whitney Machine Co.

Problems of the Machine Tool Builder

By CALDWELL R. ROSBOROUGH, Secretary, Williams, White & Co., Moline, Ill.

IN response to a request by the editor of MACHINERY, the writer has endeavored to give below his ideas as to the way in which some of the pressing problems now facing the machine tool industry must be met. It is evident that these problems are seen from different angles by different men in the business, and the writer has merely attempted to give his own views along these lines. In so doing he has considered eight important points as follows: (1) preparation for better business; (2) restoring confidence; (3) advancing machine tool design; (4) the labor problem; (5) standardizing machine shop equipment, and adopting better machines and tools; (6) efficient marketing at home and abroad; (7) greater efficiency in works management; and (8) cooperation between manufacturer and customer.

Preparing for Better Business

In the writer's opinion manufacturers should use this time to get their house in order, as it were; that is, to put their plant in a good state of repair and see that all their machinery is put in first-class shape. There has been no opportunity to do this in the last few years, and it would seem that now is a very good time. Further, it will give some men employment and it will be an expenditure that will not be wasted in any way, since it will constitute a real improvement to the plant. This should apply not only to the production end of the business, but all the way through, in the engineering, sales, and general administration of the business. The weak spots and undesirable features that have developed under the stress of busy times should be eliminated, and methods installed and provision made for handling the business in a way that the experience gained during the rush times through which we have passed has proved to be beneficial.

As to the second point—that of restoring confidence—if the work suggested in the foregoing were carried out, it would certainly create a feeling that the management of the business was not apprehensive of the future, but was making plans for the development and extension of the business at the earliest opportunity. It would thereby create a feeling of confidence and optimism in the entire business world that would replace the present feeling of depression.

Advancing Machine Tool Design

It seems to the writer that what should be done along the advancement of machine tool design at the present time is for the designing or engineering department of every firm engaged in a business of an established reputation to study their particular line in an intensive way, with a view to improving designs and eliminating duplication of parts and the consequent additional expense, wherever possible. Much can be done along this line in almost every branch of the industry. It might be advisable to withhold decisions as to changes that should be made in designs until a careful study of the subject could be made, not only from the manufacturers' but from the customers' standpoint as well; but the time to study the subject is now, when production does not present pressing problems.

Dealing with Labor

The best policy, in dealing with labor at this time, is to follow a very conservative plan of action that contemplates the utmost consideration for the men in the shop, with a view to making the conditions as favorable as possible for them from every standpoint. It seems to the writer that the day of an inconsiderate attitude toward the workmen is a thing of the past. Even though there may be two or three men for every job, it must be recognized that the day of coercion and lack of sympathy toward the men in the shop has gone forever.

Standardizing Shop Equipment and Adopting Better Machines, Tools, and Methods

The question as to what can be done in standardizing machine shop equipment is one that can best be answered by every individual shop, but it may be laid down as a general rule that standardization not only of the product but also of the equipment in the shop where the product is manufactured is highly desirable. If the equipment that is used in the manufacture of a certain product is standardized, it is more than likely that the product itself will become more and more standardized, uniform, and of improved quality as time goes on. If the various plans for improving designs and equipment were carefully studied by the management of each industry, better machines, tools, devices, and methods would be adopted automatically.

Efficient Marketing at Home and Abroad and Greater Efficiency in Management

It would seem that if a plan were worked out, whereby a number of firms would join together to establish branch offices or agencies in the different centers for the sale of their products, both for domestic and foreign trade, it would be of advantage to the producer. Of course, where the organization is large and one firm manufactures a wide line, such a method of marketing can be adopted by a single organization; but the comparatively small manufacturer can do so only by joining with others with a view to organizing branch sales offices, each firm paying its share of the expenses and receiving its share of the profits.

The human element always enters into the management of any enterprise, either manufacturing or otherwise, but it would seem that one of the things that would tend toward the efficiency of works management more effectively than any other, would be always to aim at the greatest cooperation between the different departments in the plant —sales, engineering, and production. If all departments would work closer together than is often the case, it would tend to make for greater efficiency not only in the works management itself, but in the individual efforts of everyone in all departments of the business.

Greater Cooperation between Manufacturer and Customer

It would seem that better understanding and more cooperation between the buyer and the seller—the manufacturer of machine tools and the user—can be established only by each having the utmost confidence in the other. This, in turn, can be brought about only by the manufacturer turning out an honest product and doing everything within his power to satisfy the customer, while the latter, on the other hand, will do everything in his power to treat the manufacturer fairly and squarely and not make complaints about defects for which the manufacturer should not be held responsible. If each is willing to assume responsibility and not try to pass expenses on to the other without justification, confidence can be created. In a relationship of this kind each will have the utmost respect for the other and feel that the other fellow is trying to be square with him. When such a relationship has been established, the most satisfactory cooperation between manufacturer and customer is possible.

Prospects of the French Machine Tool Trade

From MACHINERY'S Special Correspondent

Paris, July 12

BUSINESS is greatly influenced at present by the financial conditions of the government and of a number of banks who have been somewhat venturesome in supporting businesses that were not well stabilized. Recently there have been various rumors that a financial crisis was impending, but conditions have been exaggerated; and if some of the banks are embarrassed, most of them are in good condition. The result, however, is that all banks have been forced to deal very cautiously with their clients, and commerce and industry has lost the necessary elasticity of funds, which tends to accentuate the present depression.

It is certain that the lack of brisk buying is not due to purchasers waiting for further price reductions, but to the fact that the demand for their own products is slight. Iron and steel, and a great deal of manufactured material, are being sold at one-third the price paid less than a year ago; yet the present prices are still from two and one-half to three times the maximum prices of 1913. These high prices are due to the cost of labor.

Likelihood of Price Agreements

On the one hand it seems that the metal-working industry cannot resume normal activity without further reducing prices, but on the other hand it cannot reduce prices without aggravating a condition that is already serious. This stagnation will hold the industry in its grip as long as it suffers from the tremendous cost of coal, labor, and transportation. No considerable reduction in these items may be expected very soon; and to prevent financial disaster manufacturers must agree among themselves not to reduce prices further, either for domestic or foreign markets. Your correspondent has not only made a study of these conditions among the producers, but has pursued this inquiry to government officials, and does not believe that he is divulging a secret in saying here that steps have actually been taken to form an agreement between steel manufacturers as to the best course to pursue. Other manufacturers would support such an agreement on the condition that their interests be protected, because the instability of the prices of raw materials so greatly affects the prices of manufactured products that no stability can be expected in the machine shop industry until there are stable prices of raw materials.

French Machine Tool Imports and Exports before the War

In order to be able to forecast the future, it is necessary to analyze the conditions in the machine tool trade in France previous to the war. France imported annually an average of 22,900 tons of machine tools. The average price was 2050 francs per ton, so that the annual value of the imports was nearly 47,000,000 francs. These machine tools were imported almost entirely from Germany, England, the United States, and Belgium—Germany supplying 51 per cent; England, 18 per cent; the United States, 19 per cent; and Belgium, 9 per cent.

Previous to the war the average annual exports of machine tools from France amounted to 6200 tons at a value of 12,700,000 francs. It will be seen that the exports from France were about 27 per cent of the imports into the country, and that the excess of imports over exports was equivalent to 34,300,000 francs. The exports were mainly to South America, Belgium, the French Colonies, Holland, England, Switzerland, Italy, and Spain.

Machine Tool Production in France before the War

Before the war, France produced, on an average, 16,000 tons of machine tools annually, while it consumed over 32,000 tons; that is to say, it produced about one-half of its requirements of machine tools. During the war, the manufacture of machine tools in France was practically discontinued, the imports averaging during three years of the war 42,000 tons annually. As there were practically no exports during those years, France imported in this period about 30 per cent annually in excess of its normal pre-war needs. Nevertheless, we find the imports of machine tools going on at a heavy rate in the two years following the war—33,000 tons in 1919, and 56,000 tons in 1920. The latter figure includes 13,000 tons of machinery returned from Germany, making 43,000 tons as the total of actually imported new machines.

It is estimated that the productive capacity of France for machine tools has increased since the war to about 20,000 tons annually. In 1919, the exports amounted to only 2600 tons, and in 1920 to 7300 tons. Considering, therefore, both the imports and the domestic production in 1919 and 1920, and subtracting from these figures the exports, we find that the actual consumption of machine tools in France was 50,400 tons in 1919, and 55,700 tons in 1920. This is some 18,000 and 23,000 tons, respectively, in excess of the average consumption previous to the war.

From an examination of these figures it will be seen that it was not the surplus machinery on hand from the war years, but rather the enormous importation and the slight exportation during the two years immediately following the war that caused the present lack of demand.

Estimated Future Needs for Machine Tools

Assuming that the future normal requirements for machine tools in France will be practically the same as before the war, or, say, 33,000 tons annually, and with 20,000 tons manufactured in France, it will be seen that 13,000 tons would have to be imported annually, no allowance being made for exportation of domestic French machine tools. But as there is certain to be an export trade to such countries as South America, Poland, the Balkans, etc., the actual imports into France must rise much higher. If it is assumed that the average price for machine tools stabilizes at about 6000 francs per ton, then the machine tool importations in the future would amount to 78,000,000 francs annually, not counting the excess of imports required to balance whatever exports may be made.

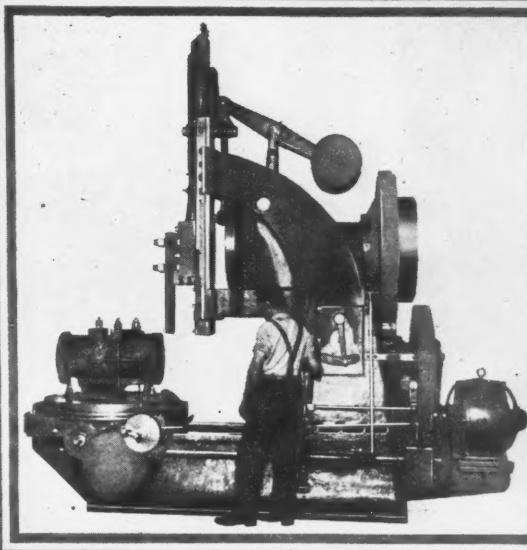
This figure is not exaggerated, as the normal needs of the country have been figured merely on the basis of the average of a number of years before the war without any increase, whereas actually the consumption of machine tools did increase by 4000 tons a year during the last few years before the war. It would seem that the figures quoted show not only the possibilities for the manufacturer of machine tools in France, but also for the exports of machine tools to France from other machine tool building countries, just as soon as conditions become stabilized and exchange returns to a somewhat more favorable basis.

French manufacturers are being encouraged to plan for an intensified production of machine tools and to concentrate on the production of lathes, grinding machines, planers, etc.; while machines such as broaching machines, automatic machines, turret lathes, etc., would be imported, particularly from the United States.

Slotting Operations on Production Work

Tooling up Slotters and Keyseaters for the Performance of Vertical Planing, Shaping, Slotting, and Keyseating Operations

By EDWARD K. HAMMOND



THE term "slotter" is somewhat misleading, as from it, one would naturally infer that the slotter is a machine adapted for performing a highly specialized line of work, similar to that handled by a keyseater. Actually, such is far from being the case, for in railroad shops and many other plants where equipments of this kind are employed, it is found that they are well adapted for handling a variety of operations, of which both internal and external vertical planing and shaping are typical examples.

Unlike the planer or shaper of standard design, the slotter handles its work while held on the table in such a way that it may be reached by a vertically reciprocating tool; and as the table is provided with a graduated circle and means of either continuous or intermediate rotation, it will be apparent that the slotter may be employed for the generation of concave or convex cylindrical surfaces, or for the planing of flat surfaces at specified angles to each other. Examples of typical jobs, where the slotter shows its productive capacity and flexibility to advantage, will be illustrated and described in the following.

Planing Gear and Pinion Teeth on the Slotter

A slotting machine built by William Sellers & Co., Inc., of Philadelphia, Pa., is employed in their plant for planing the teeth of large gears and pinions used in machine tools of this company's manufacture. Fig. 1 shows this slotter engaged on a pinion cutting job, and from this illustration it will be apparent that the cutting tool *A* is accurately formed to produce the space between two adjacent teeth. To attain accuracy in cutting gear teeth by this method, great rigidity of the tool is absolutely essential, and this is provided for by means of a jack *B* that supports the overhanging portion of the tool.

The tool starts cutting at the periphery of the blank, and the work is fed up to the tool until a stop is engaged, showing that the tooth space has been sunk to the required depth. When the operation has reached this point, the work is withdrawn from the tool and indexed through one pitch by a notched dividing plate *C* and pawl *D* that furnish a means of quickly and accurately accomplishing this part of the operation. Then the work is again fed up to the tool to cut the next tooth space, this sequence being repeated until all the pinion teeth have been cut. The blank is located by a pilot *E* which enters the finish-bored hole.

Slotting machines are used for handling a widely diversified line of work. In the present article, the examples selected have been chosen with a view to setting forth the possibilities of this type of machine, and of explaining methods that might be applied in plants engaged in the manufacture of a variety of products requiring planing, shaping, slotting, and keyseating operations that may be performed on slotting machines.

Mention has already been made of the fact that this equipment is also used for cutting gears, some of which are of considerable size. All work that does not exceed the diameter of the slotter table is handled as shown in Fig. 1; but for cutting the teeth in gear blanks of larger size, an auxiliary support is furnished, which is arranged as shown in Figs. 2 and 3. Fig. 2 shows the work of planing teeth in a boring mill table gear, and it will be seen that the cutting tool and method of supporting it are the same as for the pinion job previously illustrated. Fig. 3 gives a better idea of the method of setting up a large gear blank. On the auxiliary bed *A* it will be seen that there is a pilot *B* on which the work is located from its previously bored hole. This pilot is supported on roller bearings, so that large pieces of work which are of considerable weight can be readily indexed for cutting successive tooth spaces.

It will be noticed that the stand *C*, by which pilot *B* is carried, is supported on a slide on the bed *A*, and that connection is made with the saddle of the slotting machine by means of two straps *D*, so that the automatic feed may be employed for advancing the work to the tool. To make this movement as easy as possible, rollers are placed between the bed *A* and stand *C* on which the work is carried, thus reducing frictional resistance to a minimum. Provision is made for outboard support of the work by means of blocks *F* and *G*, and after the work has been properly located for cutting a tooth space, it is secured in that position by means of straps and clamping bolts clearly shown at *H*. Indexing of the work is accomplished by scribing reference lines on the face of the gear blank corresponding to the tooth centers. Carried on the slotter table there are two fingers *I* which extend over the top of the work and have lines scribed on their upper surfaces. The reference lines on the gear blank are centered under these fingers, after which the casting is securely clamped by means of straps *H*, ready for cutting a tooth space.

It is not claimed that this method is capable of competing with specialized forms of gear-cutting machines that are used for handling work of this kind. However, for a shop where there is a considerable amount of slotter work to be done, and where only a moderate number of coarse-pitched gears and pinions are required, the use of a slotter fixture of this kind saves the time involved in sending such work out to a gear-cutting shop, or the investment in a gear-cutting machine that would only be kept busy for a relatively small part of the time.

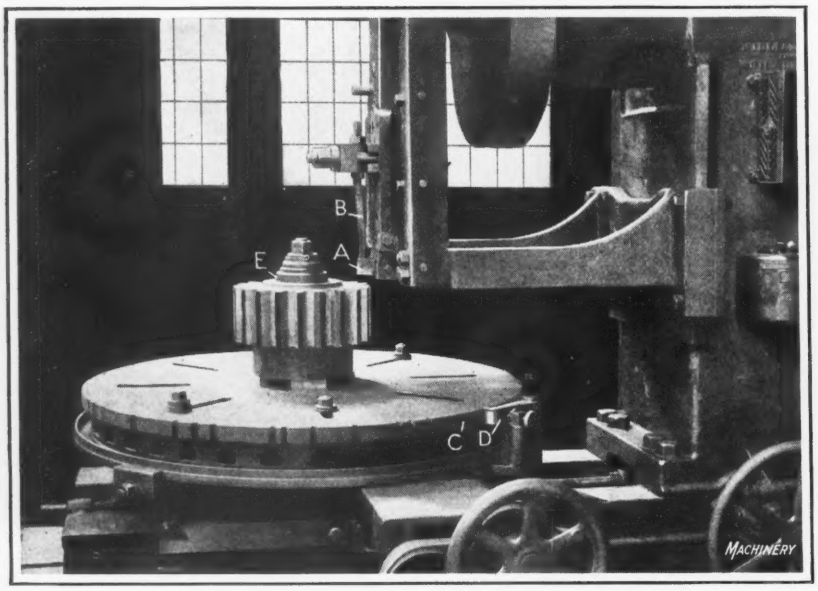


Fig. 1. Slotter equipped for cutting Teeth of Pinions

Slotting Cutter-heads

For use on milling machines of their manufacture, the Newton Machine Tool Works, Inc., Philadelphia, Pa., frequently receive orders for rotary cutter-heads, and in Fig. 5 is shown a 24-inch crank slotter built by this firm, which is engaged in cutting equally spaced slots around the circumference of a beveled blank. In this operation, it will be evident that two points must receive careful consideration, namely, the setting up of the blank at such an angle that vertical reciprocation of the ram provides for cutting the slots to a uniform depth; and the provision of means for indexing the work between the cutting of successive slots, in order to insure that the spacing will be uniform. Reference to the illustration will show that the angular setting is accomplished by means of a parallel strip *A* placed under one edge of the fixture, which raises it so that the angular face of the work is brought into a vertical position for cutting the slots.

Also, it will be seen that the work-holding fixture is provided with a mandrel *B* that enters the previously bored hole in the work, so that it is centrally located; and the fixture is held down on the slotter table by means of the familiar arrangement of straps and stops. Evidently, the tool is made the desired width of the slot, and the saddle is moved inward to feed the work to the tool as it reciprocates back and forth across the beveled surface, which is held vertically. After one slot has been cut, the work is backed away from the tool and indexed by means of a worm meshing with worm-wheel teeth *C*, cut in the periphery of the fixture, a dividing head being used to obtain the desired spacing.

Planing Valve Body Flanges on the Slotter

As an example of the way in which a slotter can be used for the economical planing of two or more surfaces on a piece of work, where a precise angular relationship is required between such faces, attention is called to Fig. 4 which shows a slotter built by the Jones Machine Tool Works, of Philadelphia, Pa., engaged in planing a 9-inch cast-iron valve body which has flanges *A* and *B* that are 15 inches in diameter. As the work comes to this machine, the facing of flange *C*, on which it is shown standing, and all the interior machining has been completed on a vertical boring machine. A roughing and a finishing cut are taken on both flanges *A* and *B*, and it will be apparent that after flange *A* has been faced, the power drive to the rotary table and the indexing mechanism provided make it an easy matter to turn the work quickly through exactly 180 degrees ready for finishing the face of flange *B*. This can be done in less than one minute, and as the job can be completed at a single setting, it will be apparent that there is a substantial saving in time, as compared with the use of a machine where two settings would be necessary. On each face, a roughing cut is taken with a round-nosed tool and a finishing cut with a square-nosed tool; the time required for setting up and taking the two cuts over both surfaces is approximately two hours.

Application of Portable Slotting Machines

Slotters are used to a considerable extent in engineering works engaged in the building of heavy machinery. For handling work of this kind it is quite often found desirable to take a machine to the work, instead of following the usual procedure of carrying the work to a machine. Particularly is this true in the case of large castings which are not only difficult to handle, but where the size and weight are such that the time required to set up a casting on a stationary machine is likely to far exceed the actual time required for making a cut. To meet the requirements of

Machining Segment Bearings on the Slotter

Another job performed on Jones slotters is the machining of cast-iron segment bearings for printing presses. The machining is done in the bore of the bearing, which is 18½ inches in diameter by 21¾ inches long, with the length of the segment one-third of its diameter. Each of these bearings is set up in a vertical position on the slotter table, and rotated continuously by power as the tool reciprocates back and forth over the work. This combination of a rotary movement of the work and reciprocation of the tool in contact with it provides for the generation of an accurate cylindrical surface. Work of this kind is frequently done on a horizontal boring mill, with the work held stationary to have the cylindrical surface generated by a rotating tool which is fed through the work. The handling of a job of this kind on the slotter is another evidence of the possibility of using machines of this type for other classes of work.

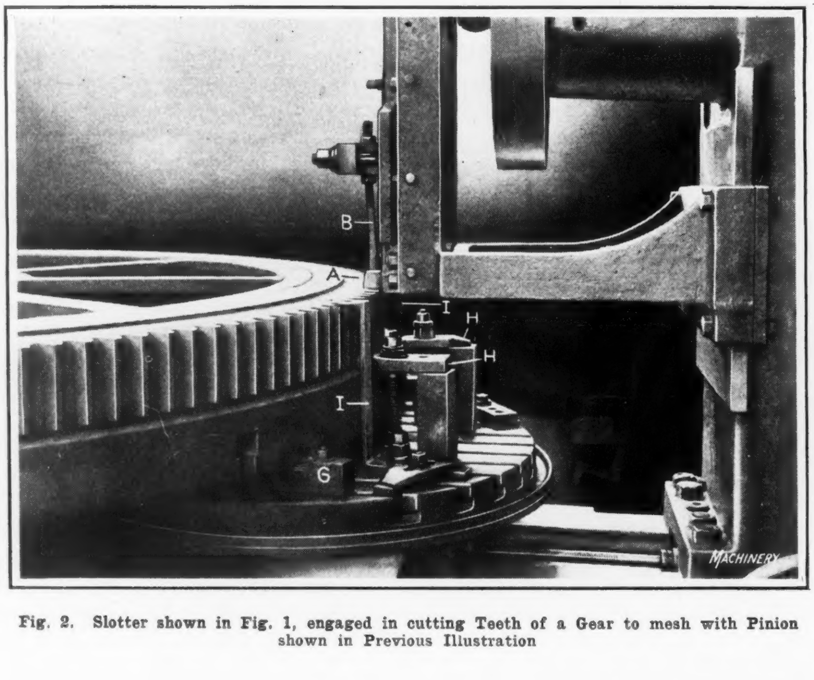


Fig. 2. Slotter shown in Fig. 1, engaged in cutting Teeth of a Gear to mesh with Pinion shown in Previous Illustration

work of this general type, many shops are provided with floor plates of the type shown at *A* in Fig. 6, on which a casting can be set up for laying out and machining.

This illustration shows the use of an auxiliary table or raising block *B*, in connection with one of these floor plates, for elevating the casting *C*, so that clearance is provided beneath it to allow a tool carried by the ram of a portable Newton slotter, to be used for facing the end of the work. Although not clearly shown in the illustration, this slotter, in common with portable machine tools built by other firms, is provided with a yoke at the top of the column, by which it can be easily picked up by the hook of a traveling crane and carried to any position in the shop where there is work requiring the use of a machine of this type.

Severity of Service for which Slotters are Adapted

Most modern slotters are rugged machines, and they are adapted for taking the heaviest cuts under the highest speeds and coarsest feeds that can be handled by high-speed steel cutting tools. Fig. 7 illustrates one of the rack-driven slotters which are built by the Newton Machine Tool Works in strokes of from 36 to 72 inches, engaged in performing a heavy rough-planing operation on a gray iron casting. This job is of interest on account of the heavy cut that is being taken, and also on account of the arrangement of the tool *A*, which facilitates handling a job of this kind. Evidently it is desirable to have as little overhang as possible for a tool that is required to take a heavy cut under coarse feed and high-speed. In the present instance it will be noticed that instead of using a cutter-bar which holds the tool bit at a considerable distance from the ram, the tool is transversely clamped to a short head, secured close to the face of the ram. As a result, there is very little danger of the development of an objectionable amount of spring, vibration, or chatter.

As a further example of the severity of service for which well built slotters are adapted, consider the case of a Newton 56-inch slotter engaged upon the planing of steel die-blocks. Working at a cutting speed of 25 feet per minute, and returning the ram at a 2 to 1 ratio, it is stated that this machine showed no signs of distress when taking a cut 1½ inches deep, with a feed of ⅛ inch per stroke. Evidently a performance of this kind is one that commends the slotter to the careful consideration of men in the planning department of a shop which has a lot of work, where it is desirable to remove a considerable quantity of excess metal as rapidly as possible.

Cutting Shrinkage Relief Slots in Locomotive Driving Wheels

It is a matter of general knowledge among foundrymen that the amount of shrinkage which occurs in steel during the period of transformation from the liquid to the solid condition, and in subsequent cooling, is greater than that of cast iron and certain other commonly used metals. As a result, the steel foundry must take certain precautions to avoid trouble from conditions caused by the development of severe shrinkage strains in the work. An example of this kind is illustrated in Fig. 9, which shows a cast-steel driving wheel center for a locomotive. Distributed around the periphery of this wheel it will be seen that there are cored slots *A* extending almost all of the way through the rim.

The purpose of these slots is to provide a certain amount of play, which will allow the wheel to adjust itself for shrinkage strains, and thus prevent danger of either breaking the casting or of so far impairing its strength that the finished wheel would be likely to fail in service. However, it will be evident that it would not do to leave these slots as they are shown in the illustration, and the method of procedure followed in the Burnside shops of the Illinois Central Railroad Co., is to set the casting up on a slotter built by the T. C. Dill Machine Co., Inc., of Philadelphia, Pa., and to slot out each of the cored openings in the rim to receive a filler block 1 inch in width. These blocks are carefully machined to be a pressed fit in the slotted openings *A*, so that they may be driven into place and constitute practically the equivalent of integral parts of the wheel rim.

The slotting operation is quite simple, consisting merely of feeding the table in toward the column of the machine, to provide for finishing one opening in the work; and after this has been accomplished, the table is withdrawn and indexed to bring the next cored opening to a position where it can be machined by the slotting tool. This process is repeated for each of the slots around the rim of the casting. The dial *B* which is graduated on the circumference of the

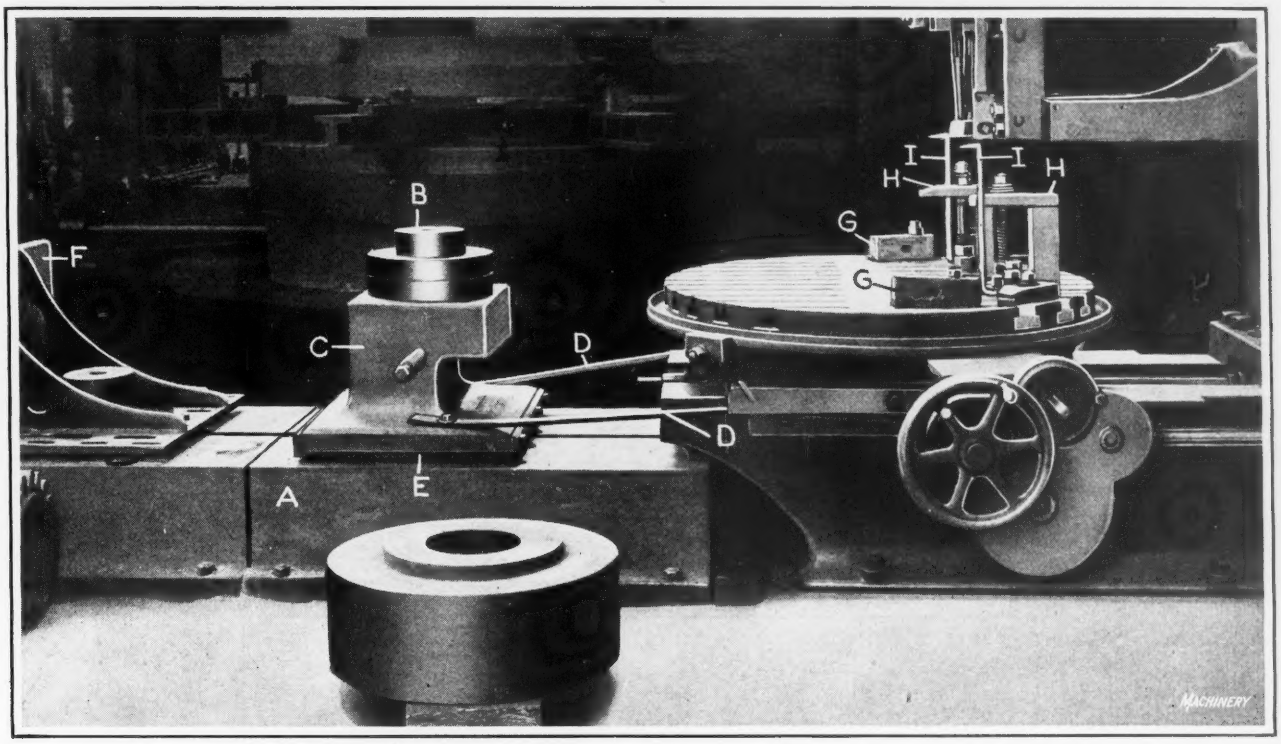


Fig. 3. Slotter with Work removed to illustrate Auxiliary Bed A carrying Arbor B, and Provision for supporting Gear at Each Side

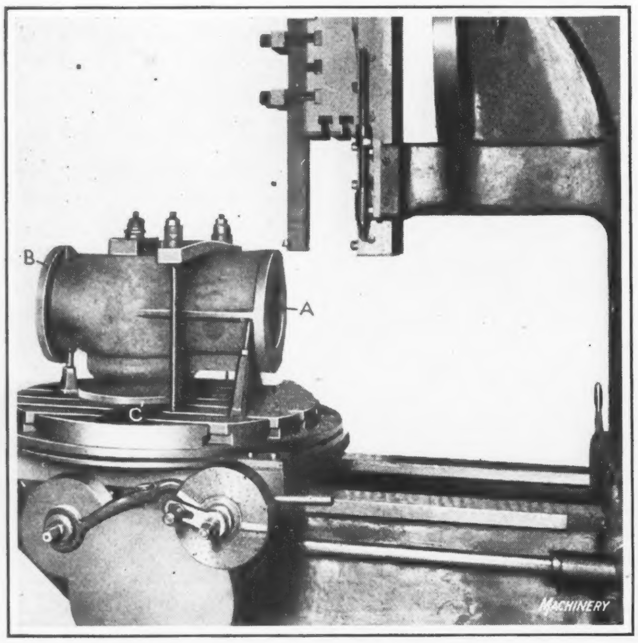


Fig. 4. Close-up View of Slotter used for facing Opposite Ends of Large Valve Body

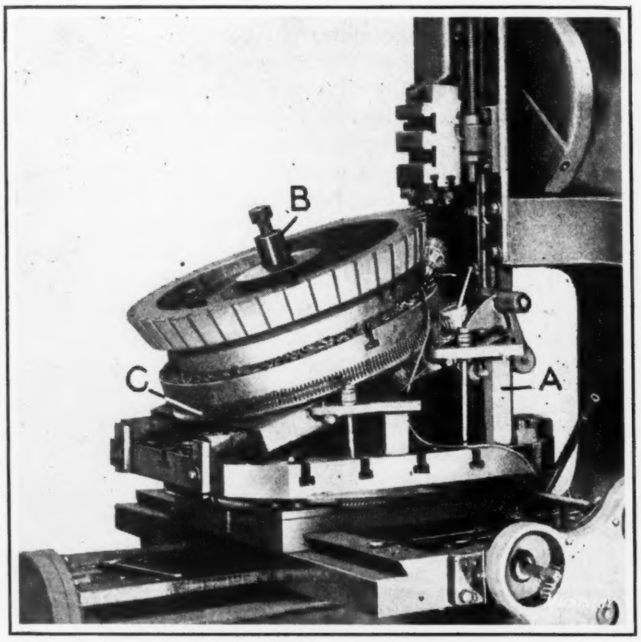


Fig. 5. Slotter used for cutting External Tool Slots around Periphery of Cast-steel Cutter-head

Dill slotter table facilitates the quick and accurate setting of a job of this kind for successive operations. As the casting comes to this machine, the hub has been bored and faced so that it can be used as a locating point. The work is placed over a central pilot, and held down on the faced end of the hub by means of straps and bolts *C* entering T-slots in the table.

Provision for Cutting the Keyway at the Same Setting

One of the important features of design of the Dill slotter is the provision made for carrying the reciprocating cutter-bar or ram on a traveling head, the position of which may be changed to adjust the reach of the slotter to suit its work. In handling the job under consideration, this feature makes it possible also to cut a keyway in the bore of the wheel center without changing the setting of the work. For this purpose, it is merely necessary to run the head out so that the tool is located over the bore where the keyway is to be cut. It will be recalled that the work is located over a mandrel at the center of the slotter table and, bearing this fact in mind, it will be evident that special provision must be made to furnish clearance for the bar carrying the keyway cutting tool. The mandrel over which the wheel center is located is not over one inch high, and its periphery is cut away at one side to allow the cutter-bar to pass below the work sufficiently to complete the keyway. The arrangement of the arbor is similar to that shown in Fig. 12. It is necessary to raise the wheel center slightly above the level of the slotter table by supporting it on blocks.

An alternate method would be to take advantage of the fact that the hole at the center of the Dill slotter table is threaded. The locating mandrel could be made with spanner holes, so that after the work was located and strapped down, the mandrel could be removed while the keyway was being cut. The straps would prove adequate to hold the work for the keyway cutting operation, without the mandrel. The first method is recommended for cutting keyways in large bores, while the latter method is more useful in the case of medium and small sized holes. Still another method would be to place the wheel center approximately central with the table, then clamp it down without the use of a centering mandrel, and obtain the required adjustment by revolving the table at high speed and centering the work by applying a piece of chalk to its circumference. The chalk is slowly moved toward the rotating wheel until it just comes into contact with the point farthest from the center of the slotter table. Then the table is stopped and the wheel is tapped with a soft hammer to correct its eccentricity with the table. This test is repeated until the chalk can be applied and will make a continuous mark all around the wheel, thus indicating that the wheel is concentric with the slotter table. Where there are only a few pieces to handle, this method would

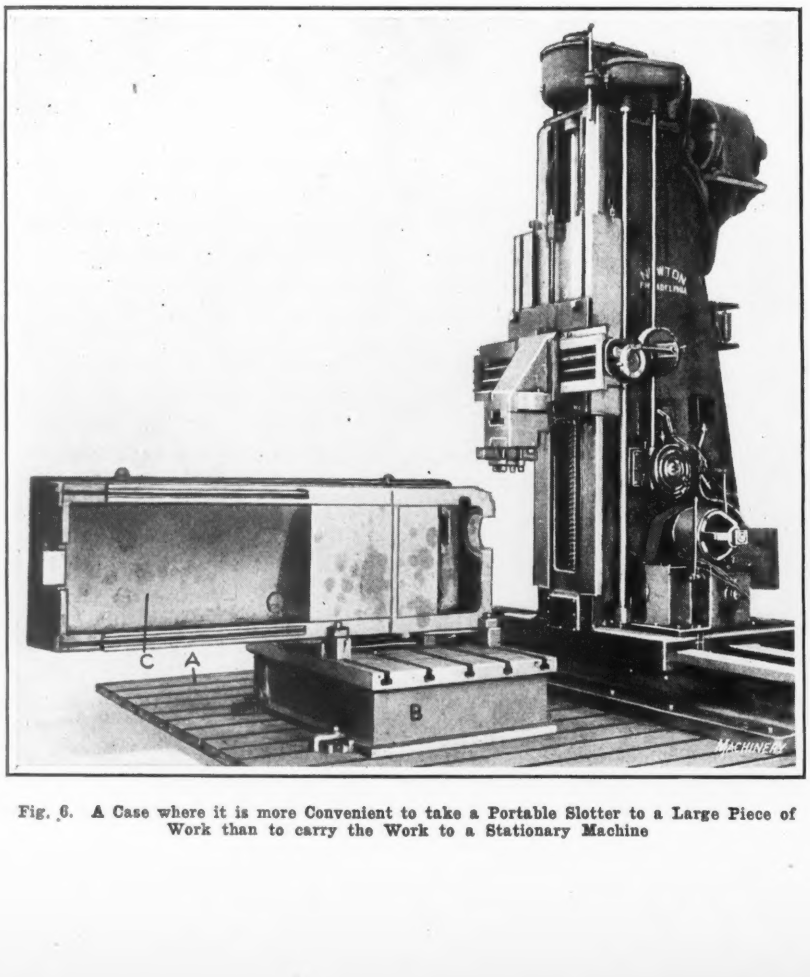


Fig. 6. A Case where it is more Convenient to take a Portable Slotter to a Large Piece of Work than to carry the Work to a Stationary Machine

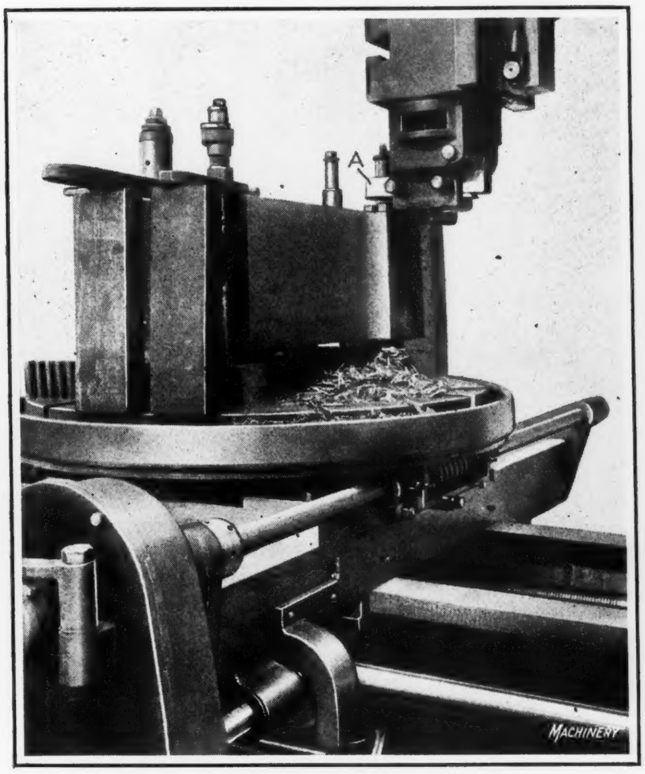


Fig. 7. A Heavy-duty Planing Operation on the Slotter

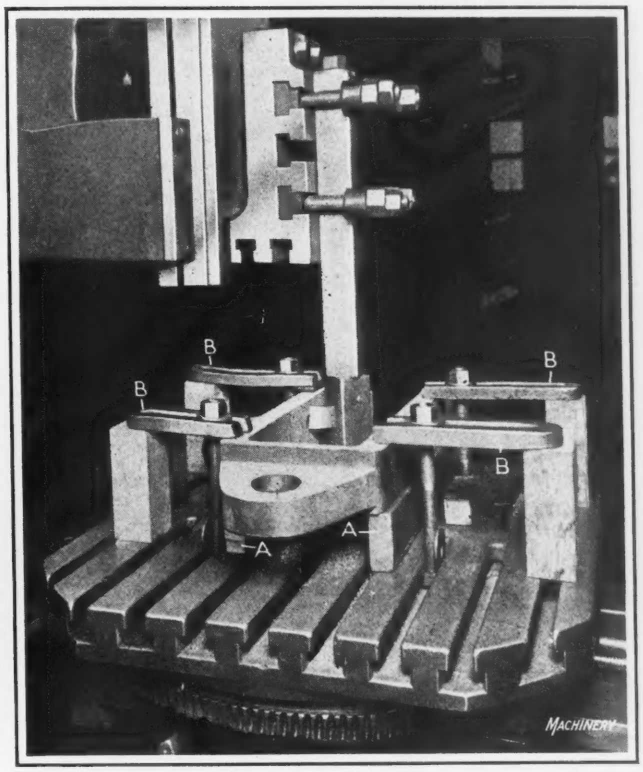


Fig. 8. Planing the Sides and End of a Side-rod Strap

be more satisfactory, because it would save the expense of making the mandrel; but, of course, it is not as rapid as the methods previously described.

Slotting the Middle Connection Side-rod Strap

It has already been explained that the field of application of the slotter extends far beyond the machining of those openings that would properly be termed "slots." A case in point is shown in Fig. 8, where a crank slotter built at the Bement-Miles Works of the Niles-Bement-Pond Co., 111 Broadway, New York City, is shown in the Burnside shops of the Illinois Central Railroad Co., engaged in machining the three sides of the opening in a middle connection side-rod strap for a locomotive. As the work comes to this machine, the upper and lower edges of the strap have been planed, so that they constitute convenient locating points; and the work is set up on the slotter table on parallels *A*, on which it is held down by clamps *B* of the usual form.

For performing operations of this general type on the slotter, attention is called to the fact that these parallels *A* raise the work sufficiently from the table, so that clearance is provided for the slotting tool to have an over-travel beyond the under side of the work. In handling an operation of this kind, advantage is taken of the combination of longitudinal, transverse, and rotary table movements that are available. On this particular job, the transverse and rotary movements are those chiefly employed. The transverse feed carries the work past the slotting tool, and after one side of the opening has been planed, the rotary table movement is utilized to index the work through 90 degrees to bring the next side into position for planing. This operation is repeated a third time for finishing the final side of the work.

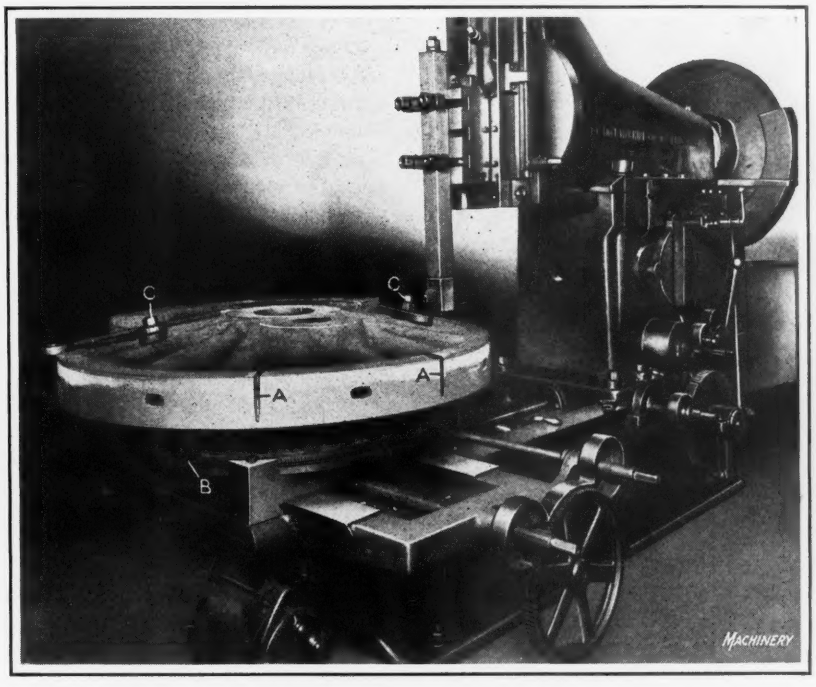


Fig. 9. Slotting out Cored Shrinkage Relief Openings in a Locomotive Wheel Rim

Shaping Locomotive Driving-boxes

Sometimes the statement is made that the majority of the slotters built in this country are sold to railroad shops and to shops engaged in the manufacture and repair of railway equipment. Be that as it may, many slotters are found performing operations in this field, and one of the more interesting jobs for which they are used is the shaping of the seat in driving boxes to receive the bearing brass. Fig. 10 illustrates one of the 30-inch, draw-cut, slotting machines built by Baker Bros., of Toledo, Ohio, engaged in performing such an operation.

A cylindrical seat is machined in the driving-box, that extends around slightly more than a semicircle, with a shoulder at each end so that the bearing brass may be pushed into place by a hydraulic press. Provision for the shaping of this cylindrical segment on the slotter is readily made by first planing the sides of the

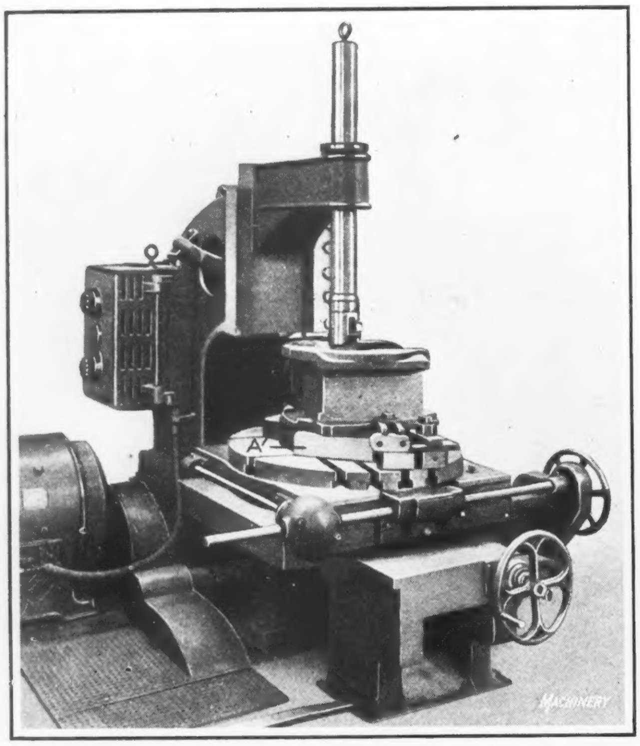


Fig. 10. Use of Continuous Rotary Table Movement on the Slotting Machine for shaping Inside of Locomotive Driving-box

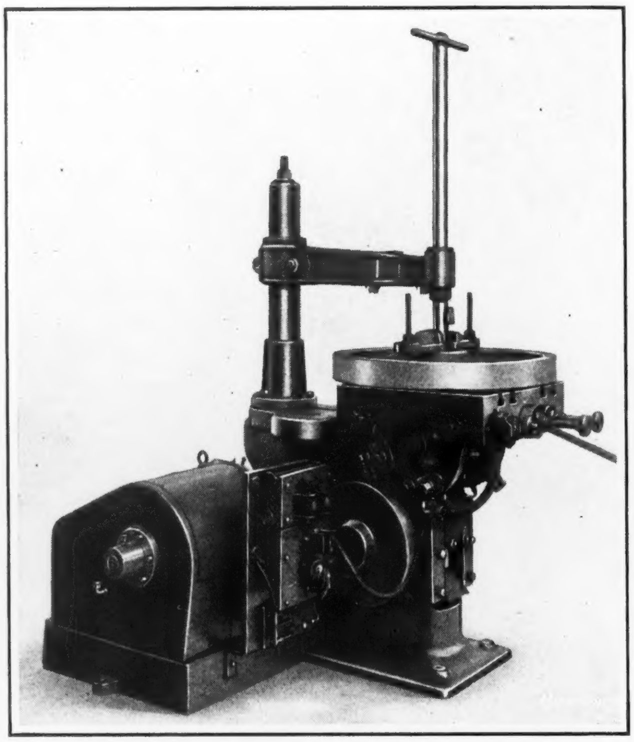


Fig. 11. Performance of a Keyseating Operation in the Hub of a Flywheel held on the Table of a Keyseating Machine

driving-box, and then setting it up on parallel raising blocks *A*, so that clearance will be provided for the tool under the work. Clamped in this manner, the tool is started at one end of the seat, and as it reciprocates over the work, the table is continuously rotated to generate the required cylindrical surface. One of these machines is capable of taking a cut 7/8 inch deep, with a feed of 1/4 inch per stroke, in these cast-steel driving-boxes. The cutter-bar is piloted in both the table and the over-arm, so that it is maintained in accurate alignment when working under such severe operating conditions.

Keyseating Operation on a Flywheel

In Fig. 11 is shown a keyseating machine built by Baker Bros., engaged in cutting the keyway in a flywheel casting. The method of operation is quite similar to that of the slotter shown in Fig. 10. However, in the present instance, the tool bit is made the same width as the keyway to be cut, so that it is merely a case of feeding the work straight up to the cutter as it reciprocates through the bearing hole. As in the case of the slotter illustrated in Fig. 10, it will be seen that the bar is piloted in both the over-arm and in the table of the machine, so that accurate alignment is maintained.

Referring to Fig. 12 which illustrates a work-holding fixture of the general type used on the machine shown in the preceding illustration, it will be seen that a hollow pilot *A* is furnished, over which the finished bore of the work is located, so that it is centrally positioned relative to the keyway cutter *B*. As in the case of previous slotting operations, the fixture *C* is cut away in the center to provide for raising the work sufficiently from the table, so that it serves the double purpose of affording clearance for the keyseating tool at the bottom of its stroke, and for chips as they are cut from the work.

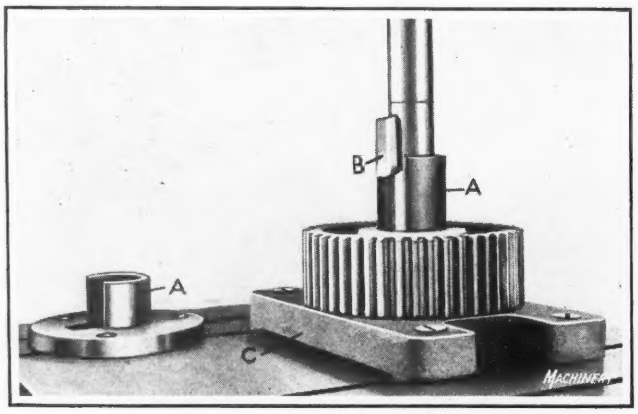


Fig. 12. Details of Work-holding Fixture and Arbor of the Type used on the Keyseating Machine shown in Fig. 11

CANADIAN METAL-WORKING INDUSTRIES

The Bureau of Statistics of the Dominion of Canada has recently published a preliminary report on the foundry and machine shop industry in Canada during 1919. From this report it appears that there are 731 individual foundries and machine shops in Canada, 418 of these being in Ontario and 134 in Quebec. The total capital invested amounts to over $100,000,000, and the value of the output in 1919 was $82,000,000. The industry employed 25,000 workers, and paid in salaries and wages about $30,000,000. The raw materials used were valued at $26,300,000. The greatest volume of business came under the heading of foundries. The value of different classes of machinery and tools made in Canada was as follows: Boilers and engines, $3,900,000; all other kinds of machinery, $12,600,000; contract work and repairs, $8,700,000; and tools of all kinds, $1,600,000.

* * *

According to a recent Commerce Report, the first loco motive built by the Armstrong-Whitworth Co., England, was delivered a little over a year and a half ago, and since that period, over 120 locomotives have been built. Immediately after the signing of the armistice, the company began work with about 800 men, while it now employs 3000 and can complete an engine in about sixteen days. It is stated that orders have been received for locomotives from the Belgian Government, Indian State Railways, Bombay Braoda Railway, Buenos Aires Western Railway, Trinidad and Java Roads, the Midland and Grand Western of Ireland, Northern Counties of Ireland, English Midland Railway, and others, including the Nigerian steam roads. The capacity of the plant is said to be limited only by the scarcity of materials—a difficulty rapidly being overcome.

Common Causes of Errors in Machine Design

Changes in Design—Lack of Concentration—Reasoning from Slight Knowledge—Comparison of Different Designs—Eighth Installment

By R. H. McMINN

ONE great cause of error in a finished product is lack of care in making changes in design and in correcting the drawings to correspond. A change in one or more details may be proposed to remedy a defect at some point in a machine without making a careful analysis as to whether the alteration will incidentally introduce effects not foreseen. Because the change is apparently a minor one the work may be entrusted to a draftsman who is not very familiar with the design of the complete machine, and yet he may be expected to proceed to carry out instructions without making a study of its design and operation. However, the proposed change in a detail may necessitate other changes in the same detail or associated details due to the need for increased strength or additional clearance, or because of some principle which has determined the original design of the part to be changed. No one is entirely competent to judge, in making an alteration, as to whether a single change necessitates other changes, unless he is thoroughly familiar with the basic principles underlying the existing design. Even if the change should be entrusted to the original designer of the machine, he should again familiarize himself with its design, if necessary, and in making any alteration should give full consideration to all incidental effects of the change.

A clear vision of all geometrical relationships involved when making any change from the original or standard drawings must be sought. No change of a detail should be made without a drawing of the assembly and associated details at hand. Making a separate lay-out of parts connecting with or in close proximity to a detail to be altered assists greatly in avoiding errors. One should design nothing for, change nothing on, or add nothing to a machine already installed without a clear knowledge of the machine, as well as the objects surrounding it.

When a change is made in any part or view while making an original design, all obvious changes which are necessitated thereby in previously drawn parts or views should immediately be indicated in some manner on drawings, so they will not be overlooked. When, while checking, a dimension is changed on one part or view, all related dimensions on all parts, views, and drawings should be changed at once to agree, if they have already been checked. All last minute changes in design should be watched carefully. Such changes may upset all previously carefully considered principles and clearances.

Too Great Dependence on Memory

Too great a dependence on memory in engineering work is the cause of many errors. It is absolutely necessary that one's memory be able to retain impressions for a certain length of time. The mere transferring of figures from one place to another involves their retention in the mind during this operation. Those figures and facts which are often used can no doubt be retained by one having a reasonably good memory with a sufficient degree of accuracy to use them without further verification; but length of time elapsing between the noting and using of a fact or figure affects the accuracy of its retention. One set of facts and figures becomes intermingled with other sets. It can be recalled that a part was made approximately a certain way and size but the exact way and size cannot be recalled with certainty. Even though one may correctly remember that a certain part had a certain dimension which is to be duplicated, it may take reference to recent drawings to determine whether such part has been changed and will affect the dimension in the new design. Therefore, as a general thing, memory should not be relied upon as a final check. Even if exact duplication of a part is not necessary, reference to a drawing of a part somewhat similar to the one being drawn may suggest valuable points in design.

Fundamental principles and basic facts not subject to change can be remembered over long periods with sufficient accuracy to base design upon. Likewise, memory can be developed as a great aid in suggesting where to look for certain facts and figures. The combined memory of the members of an organization regarding its particular business is one of the greatest assets of the concern, but an endeavor should be made to conserve mental energy and not burden the mind in trying to remember details that may be recorded for reference.

Lack of Concentration

Many mistakes are due to intermittent concentration on the work at hand, for eternal vigilance is part of the price of accuracy. The mind should not be burdened by thinking of outside matters during work in the drafting-room. There are many chances for considering and selecting the best alternatives as to how the work can be done even in tracing, and this attention helps to form a habit of concentration. Habitual concentration on a single task is less fatiguing than the mental effort necessary to constantly drag a wandering attention back to one's work.

Drawings or specifications should be read intently and not casually. They should not be read faster than one can determine the full significance of the parts read. Numbers should not be read so fast that the figures are interchanged and 1269 is read 2169. This error seems to be due to the tendency to see first the figures most easily seen, unless concentration directs the eye to reading in a certain order. When copying a number it should be read slowly and intently enough so that it is not possible to gain inaccuracy by a second reading. This concentration must be maintained in transferring the figures to any other drawing. The full significance of each figure or word must be kept in mind when writing even when there is an inclination to write somewhat automatically.

A mere glance will not comprehend all the relationships of a machine part to the whole. The entire outline must be consciously observed, the reasons for its being so understood, before a draftsman can intelligently use dimensions from the part. Do not allow the mind to be deceived by first impressions. If, when checking, a dimension of 3 inches is seen in the general locality where the checker knows there should be such a dimension, he is inclined to assume that the dimension line and arrow-heads are so located as to properly denote the dimension of the part intended; but this assumption must be verified by close observation.

In all operations, the hand and brain should be held as close to simultaneous action as possible. The mind should not be allowed to run too far ahead of the hand, or the hand may skip a figure or a word or introduce one erroneously. An attempt should be made to keep the mind off some feat-

ure of the work which must be considered at a later time before the job is complete. If questions arise or solutions of problems occur that do not bear directly on the work of the moment, written notes of them should be made to clear the mind. In starting on a train of figures or thought, an attempt should be made to carry it through to a logical stopping place. One should try, at all times, to maintain the same care when nearing the completion of a job as was used in the beginning.

Reasoning Too Far from Slight Knowledge

One great cause of error is in reasoning too far from slight experience or knowledge. There are several ways by which a designer ventures to predict what the action of any particular elements in a new machine will be:

1. He judges from the action of the same elements in the same kind of machine he is designing, either from acquaintance with an actual machine or from a treatise on the design of that kind of machine.
2. He is instructed by a superior to introduce certain elements with the superior's word that they will work as expected.
3. From his general knowledge of machinery he devises a combination of elements which appears practicable but which he recognizes to be somewhat experimental, because he does not know of the exact combination having been used before.
4. He reasons from the action of the same elements in some machine other than the kind he is designing.
5. He obtains the principles involved in designing an element or a combination from some treatise which includes the design of those elements but does not pertain to their application in the particular kind of machine he is designing or the exact conditions to which he wishes to adapt them.

Comparison of Different Designs

The designer is reasonably safe in predicting results in the first instance cited. In accepting the word of a superior he must, of course, analyze the circumstances himself to see if there is any apparent reason why the combination will not work. If the combination is new and simple, it may not need previous experimentation before incorporating it in a machine, but if complicated its proper working should be verified by experiment. When a designer predicts the operation of certain elements by comparison with an entirely different kind of machine or from a treatise on the design of such elements which does not cover the exact conditions in which he must use them, he must be especially careful.

Too great a departure from the proportions of the elements with which one is making a comparison or the conditions under which they work may introduce effects which the designer may not suspect if he is relying chiefly on his past experience and does not know all of the laws affecting the design of the elements. A radical change in the distribution of metal in a certain type of casting may introduce shrinkage strains which existed to a much less extent in the original casting. A large cast-iron gear on a certain machine may have had the rim, spokes, and hub especially proportioned to reduce such strains. Unless a designer knows the tendency of such castings to crack by unequal cooling, he may use a gear approximately the same except with a specially large thick hub with special bosses on it, which will radically increase shrinkage strains.

The designer may recall from his past experience where an unbalanced cast-iron wheel rotates satisfactorily at a thousand feet per minute peripheral speed. He may not even know of the comparatively slight strains in the metal that were produced by centrifugal force, and the effect of lack of balance may not have been evidenced. The wheel may have been fitted to a shaft that rotated in cast-iron bearings lubricated merely from an oil-hole, which properly served the purpose at slow speed. However, if this wheel were rotated at a peripheral speed of five or six thousand feet per minute the action of centrifugal force in producing internal strains and unbalanced effects would have to be considered as well as the desirability of changing the material of the bearing, its length, the method of lubrication, and the size of shaft. Therefore if one who is ignorant of the laws affecting the rotation of such a wheel should use at high speed exactly the same design for wheel and bearings that had been used at low speed, thinking that the only change was one in speed, in all probability he would get into trouble.

All substances are affected by changes in temperature. If the temperature to which certain parts will be exposed in a new machine differs greatly from that in which they were known to have been used satisfactorily in another machine their durability or operation in the new machine may be affected. This is especially true of non-metals like cloth, rubber, leather, hemp, or manila rope and wood, because these materials are damaged by heat at relatively low temperatures. Combinations using water as one element must be considered in reference to operating temperature, because of the comparatively limited range in temperature between which water freezes and boils. The strength of metals used in machine construction starts to decline at temperatures ranging from 200 to 700 degrees F.

Reference to Treatises on Design

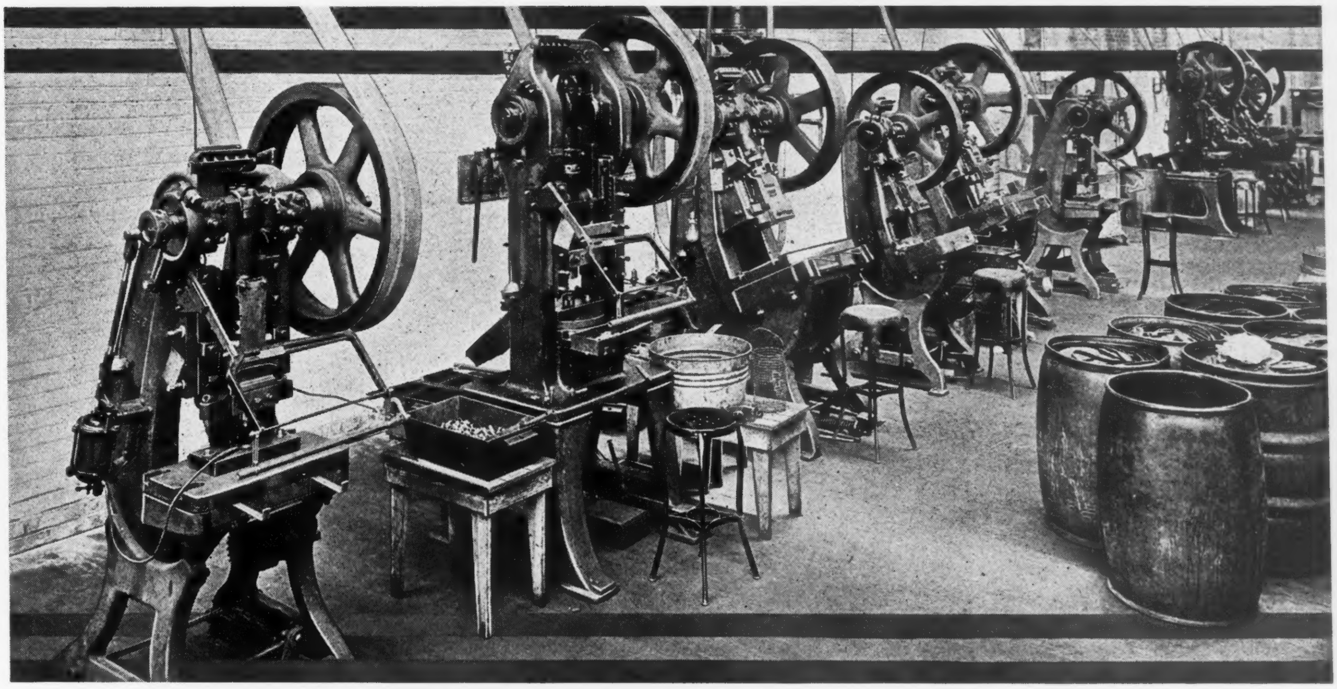
When a designer consults a treatise which covers the principles involved in the design of a certain kind of part, he is liable to fall into error if the authority he uses does not give all of the principles which he should know for his particular condition. Books on machine design generally cover the bursting strain produced by centrifugal force on the rim of a rapidly revolving wheel, but many do not call attention to the unbalancing effect of a single mass, as a boss, which is off center on such a wheel. Some elementary books on strength of materials go into the strength of various sections in bending, usually including the I-beam, and base its strength on section modulus only. They do not state that the effective strength of an I-beam when subjected to bending may be considerably reduced unless it has lateral support to reduce the strains in the compression flange, nor that under certain conditions stiffeners must be provided to prevent crippling of the web. Therefore, if a designer is working with elements with which he is not entirely familiar, the selection of the authorities to consult regarding their design is important. He should endeavor to select for reference a treatise which is sufficiently comprehensive so that his reasoning may be based upon all of the principles involved.

Relation of Other Machines or Equipment

A designer should not proceed with insufficient dimensions or information. One frequent source of error is in the lack of knowledge of the characteristics of machines which may have to be purchased to go with the machine one is designing, such as engines, pumps, fans, motors or other electrical material. The machine being designed may depend partly upon the characteristics, or some special feature or size of one of these machines, and he must therefore become sufficiently familiar with the type to be used to avoid errors in his design.

He must also know the exact shape and size of any other special material to be ordered for the machine, such as ball and roller bearings, clutches, chain, valves, bolts, screws, as well as lumber (the sizes of which when dressed are less than nominal sizes). He must not only know the characteristics and sizes of all equipment and material to be purchased, but must so definitely specify and describe such items on bills of material that no one can misinterpret what is required.

The concluding installment of this series of article will appear in September MACHINERY.



The Use of Inclinable Power Presses

Distinctive Features and Class of Work Advantageously Performed

By N. T. THURSTON, The Acklin Stamping Co., Toledo, Ohio

THE field of inclinable power presses is comparatively small work which can be produced from sheet metal, fed laterally past the punch and die from rolls, the force of gravity being utilized for carrying the completed part off the press into a suitable receptacle. However, the stock may also be fed in long strips and, generally, transversely through the machine. Although inclinable presses are limited to manufacturing small parts, this is not because the type of press limits the size of work that can be handled, but because the class of work limits the size of press on which the necessary operations can best be performed.

The advantages of feeding the stock in strips, or from a roll, and of utilizing the force of gravity for disposing of the finished parts are applicable only to small work, and so presses of the type being considered are of limited size, the largest having an over-all height of about 9 feet and a weight of approximately 9600 pounds, while the smallest is about 3 feet in height and weighs about 300 pounds. The smaller presses are not equipped with legs, as they are intended for bench use. Most of the presses in use are well within the limits mentioned, in size and weight.

The feeding of stock across the front of the press is made possible by a gap between the table and the portion of the frame supporting the ram. This construction will be apparent by reference to the illustrations in which presses are depicted. The same construction is found in many types of punching presses. The utilization of the force of gravity to carry the completed part away from the die is accomplished by tipping the frame backward so that the ram is positioned at an angle from the vertical. As will be seen in Fig. 1, the frame of an inclinable press is circular on the bottom to permit it to be placed at different angles of inclination. Advantage need not necessarily be taken of this means of removing work from the press, and so presses of this type are frequently used with the ram positioned vertically.

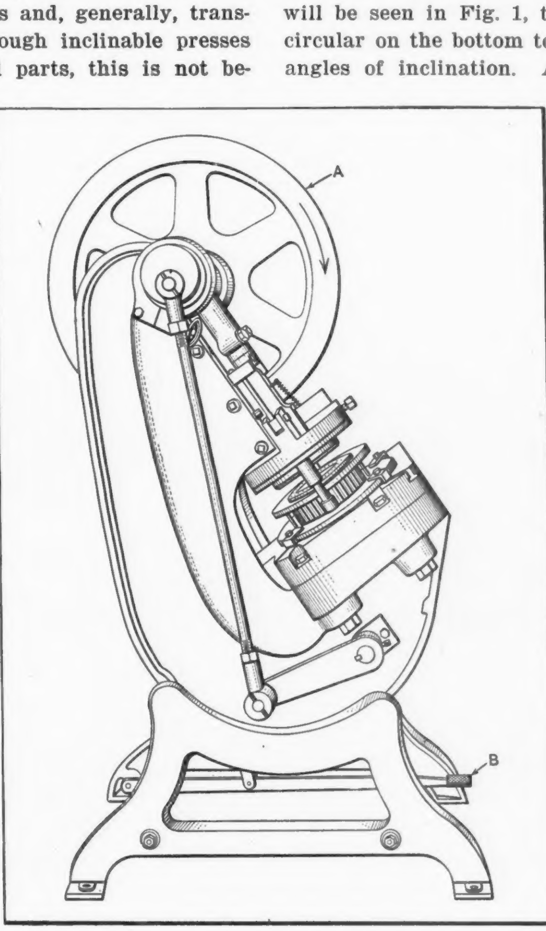


Fig. 1. Inclinable Power Press

Inclination of Presses

The inclination of presses is regulated by various mechanical devices on different machines. Some presses are provided with a set of gears actuated by a crank for the purpose, while others are swiveled by turning a handwheel attached to a vertical screw, the handwheel being located between the legs of the press. The machine illustrated in Fig. 1 is of the ungeared type and is driven by a belt connected to the flywheel pulley *A*. An opening in the back of the frame allows the feeding of strips of stock through the machine in addition to the lateral feed. Most inclinable presses are equipped with a pin-type clutch for transmitting motion from the flywheel to the crankshaft, this clutch being capable of quick engagement and dis-

engagement. The clutch is engaged by depressing the foot-lever *B*. While there are several designs of inclinable presses, the one illustrated is representative of the general principles incorporated in all presses of this class.

The degree of inclination depends upon the work and the type of die being used. For example, in Fig. 2 a combination blanking and drawing die is employed for the production of brass cups used as face-powder containers. These cups are light in weight, and so a considerable inclination of the press is required to cause them to slide away from the die rapidly enough so as not to interfere with the continually descending and ascending punch. The cups are made from brass stock placed in rolls at the right of the machine and fed across the die. An inclinable press is particularly suited for this work.

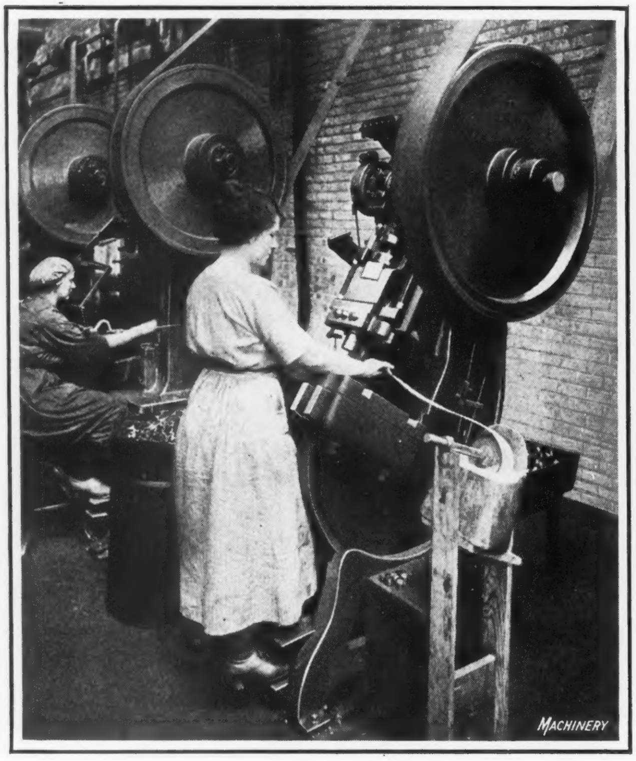


Fig. 2. Producing Small Brass Cups from Stock fed from a Roll, on an Inclinable Power Press

Classes of Work Readily Performed on Inclinable Presses

The part produced by the machine shown in Fig. 2 is illustrated at *I*, Fig. 3. This illustration shows a number of parts typical of the classes which can be successfully produced on inclinable presses. Those shown at *A*, *B*, *C*, and *J* are blanked and pierced, the operations being performed by follow-dies as the stock is fed across the machine while the latter runs constantly. This continuous operation of the press, which is possible because of the rapid removal of completed parts from the die, permits high rates of production. At *L* is shown a small tinware part used in the base of a vacuum bottle. This part is made complete in one stroke of the press, that is, it is blanked, drawn, and stamped. It is fed from narrow sheet metal in rolls, and slides from the die into a pan at the rear of the machine at the rate of about 15,000 parts per ten-hour day. The appearance of a valve-spring retainer at the end of a blanking, piercing and drawing operation is shown at *H*. The parts *H*, *I*, and *L* are drawn to some degree, and it is on work of this nature that an inclinable press is limited to a certain depth of drawing. The quick-action characteristic of ungeared inclinable presses does not permit the forming or drawing of even small parts to any great depth. This is true for the reason that in drawing metal opportunity must be given to permit the metal to flow under the pressure of the die parts. A quick sharp impact will not give the metal this opportunity, and so causes it to crack and tear.

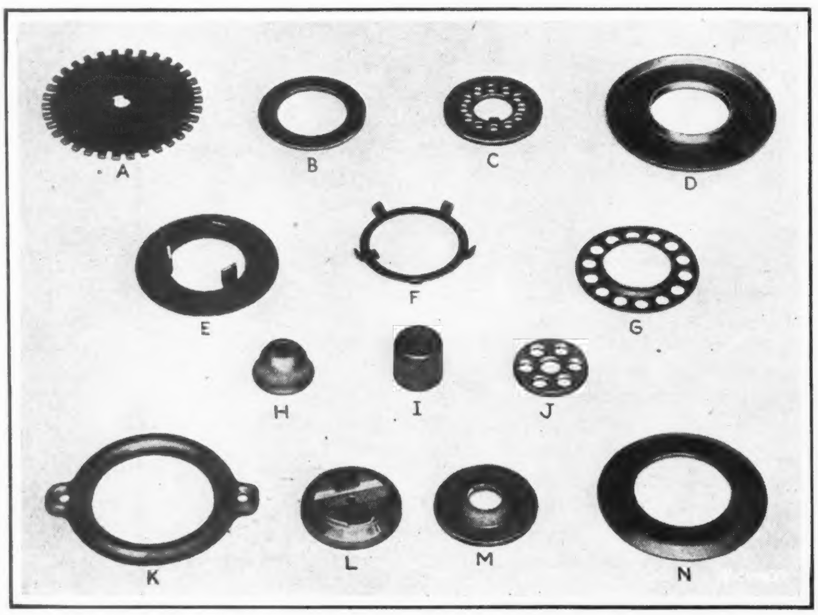


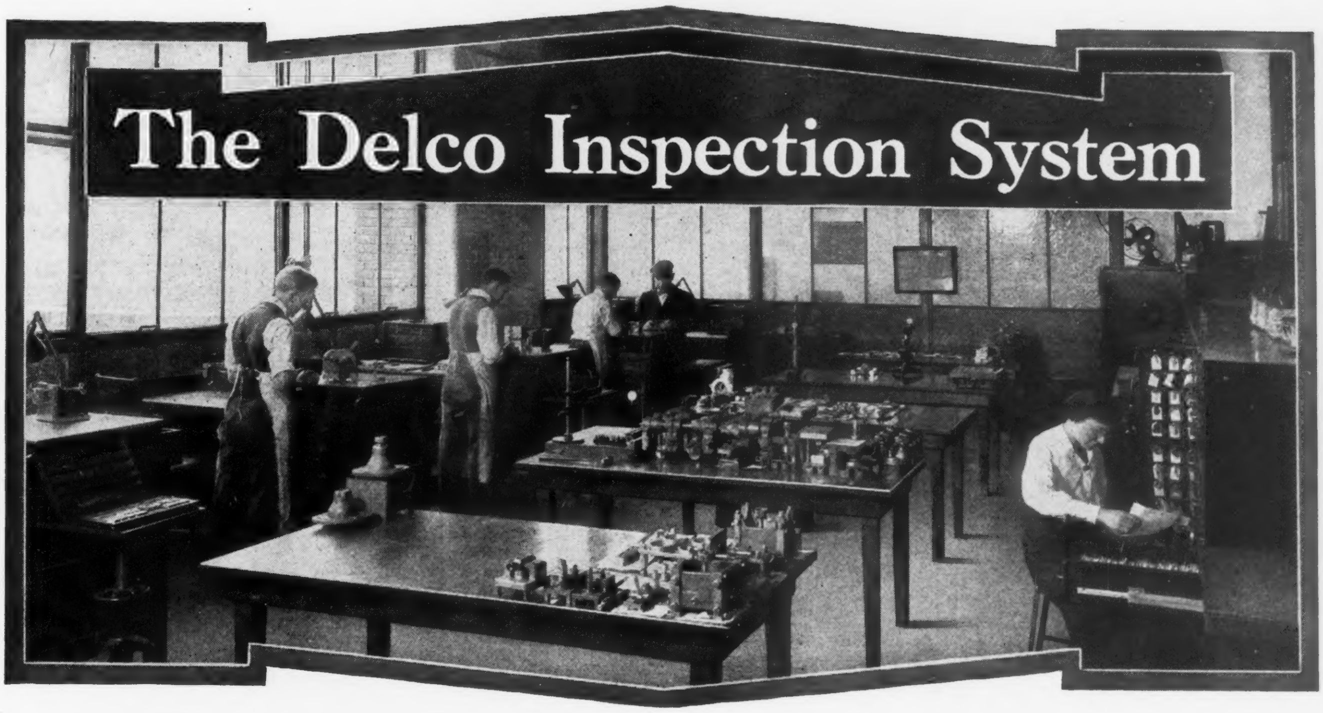
Fig. 3. Specimens of Work of the Sort for which Inclinable Presses are Most Suitable

All the work so far considered has been produced in one operation with either a single die or a follow-die. Although one-operation work is best suited for manufacture on inclinable presses, other parts which require subsequent press operations can also be produced if the dies are constructed so as to eject the part at the conclusion of each operation and allow it to slide away by gravity. Those parts illustrated at *D*, *E*, *F*, *G*, *K*, *M*, and *N* represent work of this sort. These parts are first blanked from long strips of stock on an inclinable press, and then finished in following operations on presses of the same type. The subsequent operations do not allow as rapid a production as the blanking operation, due to the inability of feeding the pieces as quickly. Nevertheless, no work on the part of the operator is necessary to remove the piece from the press, and this feature alone permits greatly increased rates of production. There is a great variety of mechanisms for the purpose of rapidly and automatically feeding parts to the die, such as disk feeders, hopper feeders, etc., but as the work is generally of the nature shown in Fig. 3, the force of gravity alone is relied upon to remove it from the die. All photographs here reproduced were taken in the shops of the Acklin Stamping Co., Toledo, Ohio.

* * *

TRAINING WORKMEN IN SAFE PRACTICES

It is estimated that 90 per cent of the shop and factory accidents of this country are caused by inattention, carelessness, or lack of skill or judgment. For this reason the training of workmen in safe practices should be given at least as much attention as the installation of machine guards. The training of workmen along these lines should be so thorough that they will be constantly on the alert to detect and avoid dangerous working conditions, as well as to correct "chance-taking" habits. It is claimed that a reduction of from 25 to 75 per cent in accidents has resulted from the establishment of safety organizations in certain plants, and that this decrease in accidents has been accompanied by greater output, product of better quality, and a decrease in the labor turnover.



Typical Examples of Gaging Fixtures Used by the Dayton Engineering Laboratories Co. in the Manufacture and Inspection of the Company's Product—First of Two Articles

By ERIK OBERG

IN the articles published in the May, June, and July numbers of MACHINERY, the principles of inspection, the inspection system used by the Dayton Engineering Laboratories Co., Dayton, Ohio, and the general tool and gaging system employed by the company, were described with special reference to the main features of the system. The present articles will describe specific gaging and inspection fixtures that are typical of those used in the company's plant. The examples that have been selected for illustration will give a comprehensive idea of the extensive use that is made of special gaging fixtures in this plant, and will indicate the methods that are employed in designing these, to obtain accuracy of inspection as well as simplicity and rapidity in handling the work. This article will be continued in September MACHINERY, completing the series.

Concentricity Gages

One of the important classifications of gages used in practically all lines of manufacture, and especially in the manufacture of apparatus in which armatures or other cylindrical parts rotate, is concentricity gages. These may be designed in various ways, but the method generally followed is to provide a base with an upright on which the part to be gaged is placed so that one of the cylindrical surfaces to be tested for concentricity fits over some part of the upright. The upright has a hole or bushing in it, concentric with the surface mentioned, which is intended to receive a plug, the latter, in turn, being provided with some kind of ring or swinging gaging member which will fit over some other surface, the concentricity of which is to be gaged.

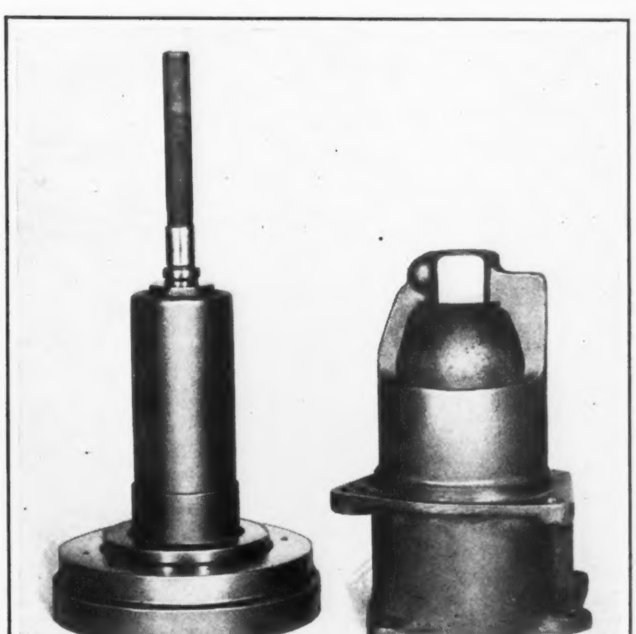


Fig. 1. Concentricity Gage

A simple example of a gage of this type is shown in Fig. 1. The work to be gaged is shown at the right, and the gage itself at the left. A hole in the lower part of the casting to be gaged fits over the cylindrical portion at the lower end of the upright of the gage. The plug gage shown has a pilot which fits into a bushing in the upper part of the upright, and the concentricity of the hole in the upper part of the casting is gaged by the protruding shoulder on the plug gage fitting into this hole as it is pushed into position. A somewhat similar concentricity gage is shown in Fig. 2. Here the work is represented by the dot-and-dash lines *A*. The bushing *B* locates the work on the fixture, the object of which is to test the concentricity of the bore *C* and hub *F* with *B*. After the work is placed in position, bore *C* is tested by simply pushing down the plug gage *D*. After the plug gage is in place, bushing *E*, mounted on it, is pushed down over hub *F*, thus testing the relative concentricity of the cylindrical surfaces at *B*, *C*, and *F*.

Concentricity Gage for Pole Pieces

A concentricity gage intended for gaging the concentricity of pole pieces after the poles and field coils are assembled in the frame is shown in Fig. 3. The dot-and-dash lines show the frame and poles in place on the gage, the frame being located by surfaces *A*. The base of the gage is provided with a collared stud *C* on which bushing *B* is a good sliding fit. Bushing *D*, in turn, is

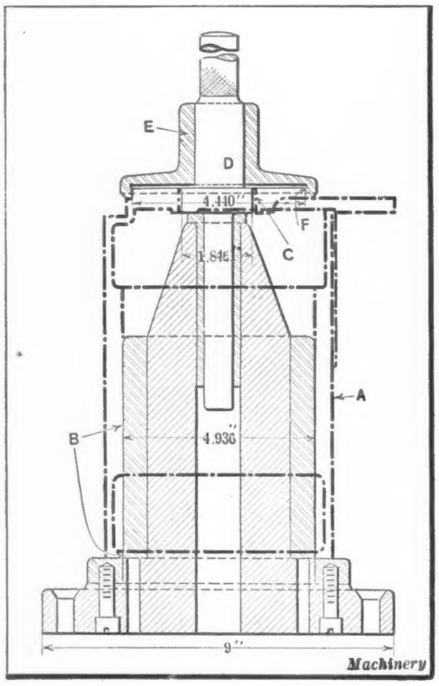


Fig. 2. Gage for inspecting Concentricity of a Bore with a Hub

mounted on bushing *B* with a press fit, the two bushings resting on the collar of stud *C*. Gaging member *E*, which is a hardened tool-steel part, is let into a slot or keyway in bushing *D*, and held in position by screws as shown. When the work is mounted on the fixture, part *E* should be able to revolve entirely around without touching the pole pieces *F*. The diameter of the hole through the pole pieces has previously been tested by limit plug gages, and the gage shown is intended only for testing the concentricity of the pole piece with the cylindrical surface *A*. The knurled handle at the upper end is pinned to bushing *B* to permit revolving the gage portion when using the fixture.

Concentricity Gages for Bearing Plates

Fig. 4 shows a series of gages used for inspecting the concentricity of various holes and hubs in the bearing plate shown by the dot-and-dash lines. The gaging fixture at the left is used for gaging the concentricity of the hole *D* with the hub *E*. This is done by simply pulling plug *A* upward after the work has been placed in position in the fixture. Plug *B*, shown at the left of the fixture, is used for testing concentricity in the same way as plug *A*, except that it is used after a bushing has been assembled in place in hole *D*, this being done in a subsequent operation.

The fixture in the center of Fig. 4 is employed for gaging the concentricity of hole *F* with the surface *J* in the same way that hole *D* is gaged in the fixture to the left, and the plug *G* is used for testing the hole after the bushing is in place, in the same manner that plug *B* is used.

The fixture to the right is used for testing the center distance between the two holes *D* and *F*. The work to be gaged is slipped over bushing *H* mounted on a stud inserted in the fixture, and plug gage *I* is then pulled upward, thereby testing the center distance between the two holes.

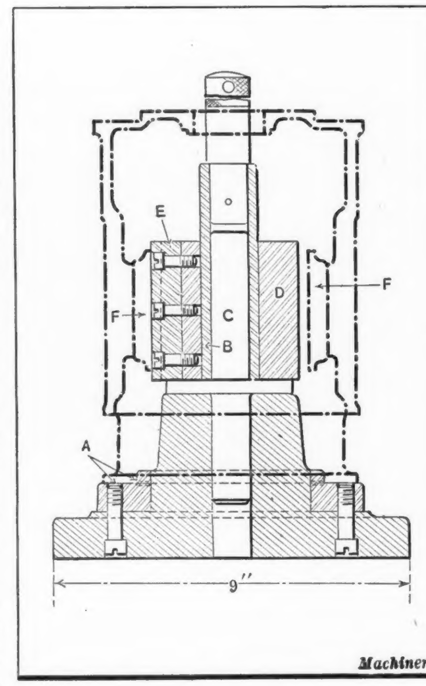


Fig. 3. Gage for inspecting Concentricity of Pole Pieces after Assembly

Inspection Gage for Motor Generator Frame

A box type inspection gage, used in inspecting the frame of a motor generator for a starting and lighting set, is shown in Figs. 5 and 6. The frame is shown at the left in Fig. 5, and consists of two malleable castings bolted together. This frame is inserted in the box gage for testing the location and concentricity of various holes and surfaces; its position in the gage is shown by dot-and-dash lines in Fig. 6. The object of the gage is to test the location of the bore *A* (the same reference letters are used to designate the same parts in both illustrations), with relation to the three dowel holes *B* on one side of the frame and the three dowel holes *C* on the other side. It also tests the relation

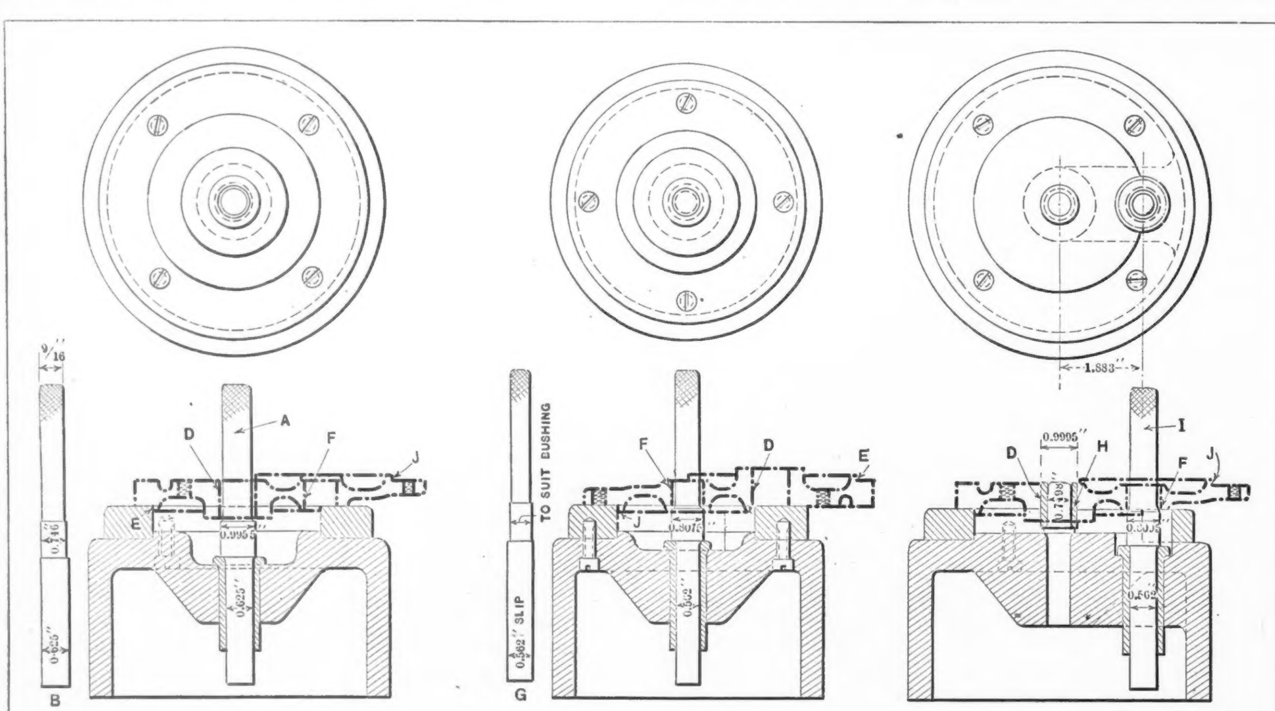


Fig. 4. Series of Concentricity Gages used for inspecting the Relation between Various Surfaces of a Bearing Plate

of the surfaces D, E, and F with relation to the bore A, and enables the location of the two holes G and the dimension H to be checked.

As will be seen by an inspection of Fig. 6, the work is located by being placed over three dowels in the bottom of the fixture, located to correspond with holes B. The location of the dowel-pin holes C on the opposite side is then tested by plungers P, which are carried in the cover of the fixture and are provided with bayonet locks so that they can be kept out of the way when the work is put in place. The location of surface D is tested by two feeler gages or plungers I, while the location of surfaces E and F is determined by the use of a limit plug gage passed between these surfaces and the hardened gaging blocks K. The location of the holes G is tested by the plungers L, and the length H is determined by the feeler gages M. The concentricity and the location of the bore A is determined by the use of plunger J provided with a handle N at the top for convenient manipulation.

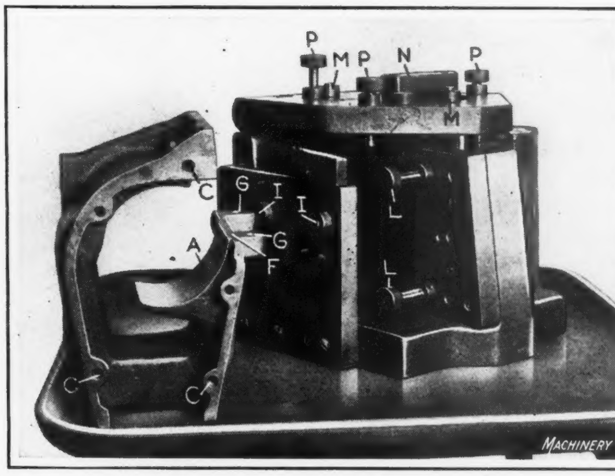


Fig. 5. Box Type Gaging Fixture for Motor Generator Frame

Inspection Gage for Distributor

Fig. 7 illustrates an inspection gage used for the final mechanical test on the assembled distributor for a well-known automobile. A similar gage is shown in detail in Fig. 8, with the position of the work indicated by dot-and-dash lines. The object of the gage is to test the location of the tapered end of the shaft A with reference to the holes into which threaded plugs C enter, and also to determine the vertical location of the center of A.

The work is located on the gage by the threaded plugs C screwed into the holes in the distributor. The base of the distributor rests upon the hardened pad D. Disk E is slipped over the tapered stud A before the piece is placed in the fixture. After the work is located, plunger F is slipped into place and by having a "Go" and "Not Go" step at its inner end, the checking of the radial distance 0.997 inch will test the vertical location of the tapered shaft A. A "Go" and "Not Go" plunger G is used to test the lateral position of shaft A with reference to face B of the disk, thereby also testing the location of the taper with reference to the threaded plugs C. Finally the concentricity of the tapered shaft A is gaged by revolving disk E while in contact with the plunger of an Ames indicator H.

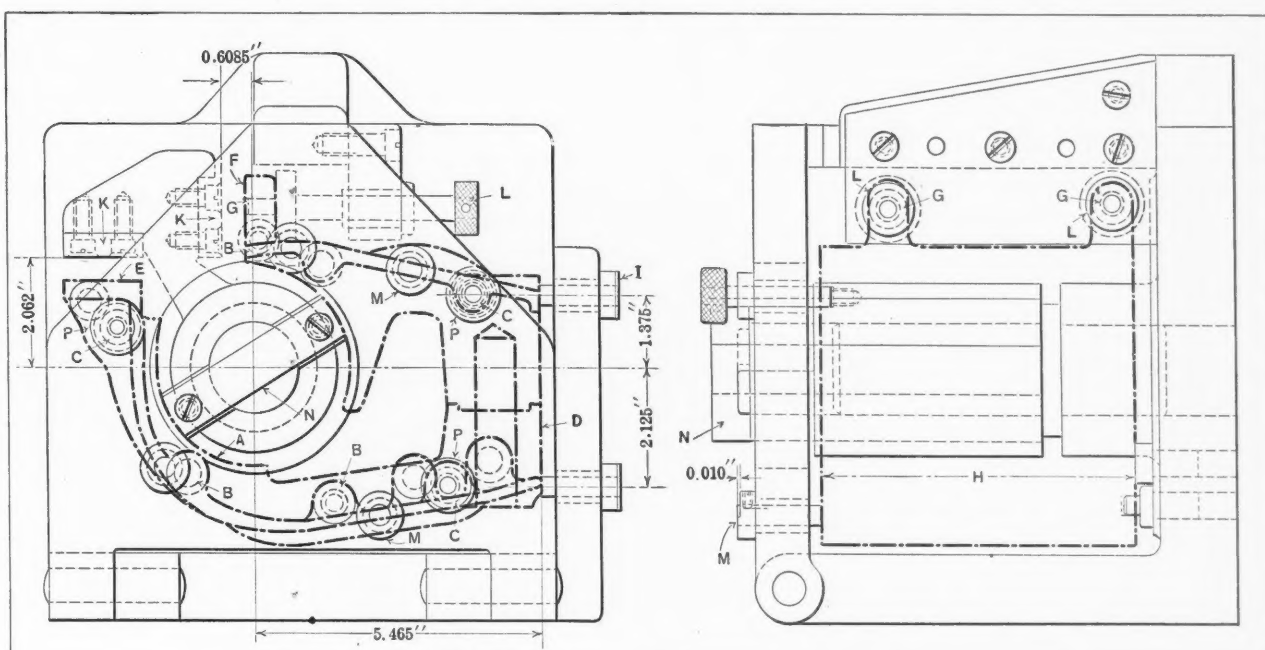
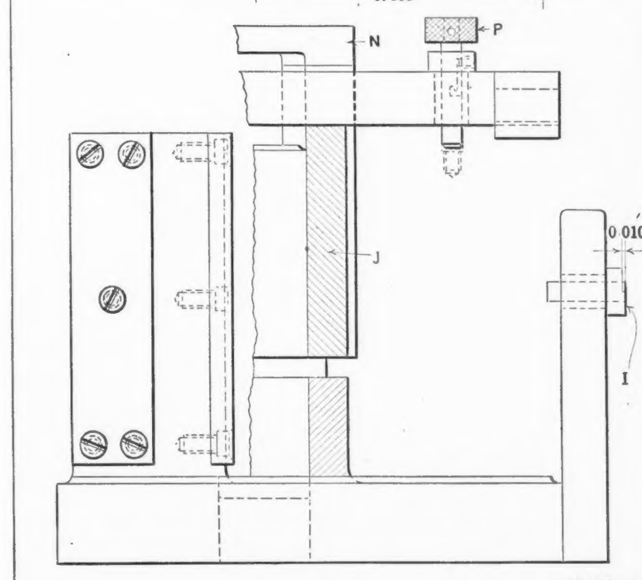



Fig. 6. Detailed View of the Gage shown in Fig. 5 with the Position of the Work and the Relation of the Gaging Points indicated

Master Gage for Motor Generators

A master line-up gage for the final mechanical inspection of motor generators is illustrated in Figs. 9 and 10. In this fixture a number of different qualities of the motor generator are tested. The free running of pinion A with its mating gear is tested by operating the lever B which has a gear segment engaging with gear A. The concentricity of the outside diameter of gear A is tested by a bushing D which is moved upward by a spiral movement, actuated by handle F. The dimension L, which determines the location of gear A, is tested by a "Go" and "Not Go"

plug gage. This actually determines the length of dimension M, which is the important dimension in this case. The flat surface G, the cylindrical surface H, and the dowel-pin I, are the means by which the motor generator is located in the inspection fixture.

The fixture is also used in checking the action of the motor brushes on the commutator. The starting or cranking mechanism of the generator is set in motion to start the automobile engine by depressing a foot-pedal. The depression of this pedal not only brings the motor brushes into contact with the motor commutator but also brings the starting gears into mesh. In order to insure quiet meshing of the gears, the contacting of the motor brushes with the commutator and the meshing of the gears must be properly timed. Referring to the illustrations, lever J corresponds to the starter foot-pedal of the automobile, and pin E is a duplicate of the motor-brush actuating pin used in the assembled unit. As lever J and pin E are pinned to the same shaft, the motor brushes can be brought into contact with the commutator by moving lever J. The point of contact or timing of the brushes is clearly shown by having an electric lamp connected in circuit with the commutator brushes and by providing a series of graduations at K, Fig. 9. If lever J reaches a certain predetermined graduation mark when the electric lamp is lighted, due to closing the circuit, it shows that the timing of the contact between the motor brushes and the commutator is accurate.

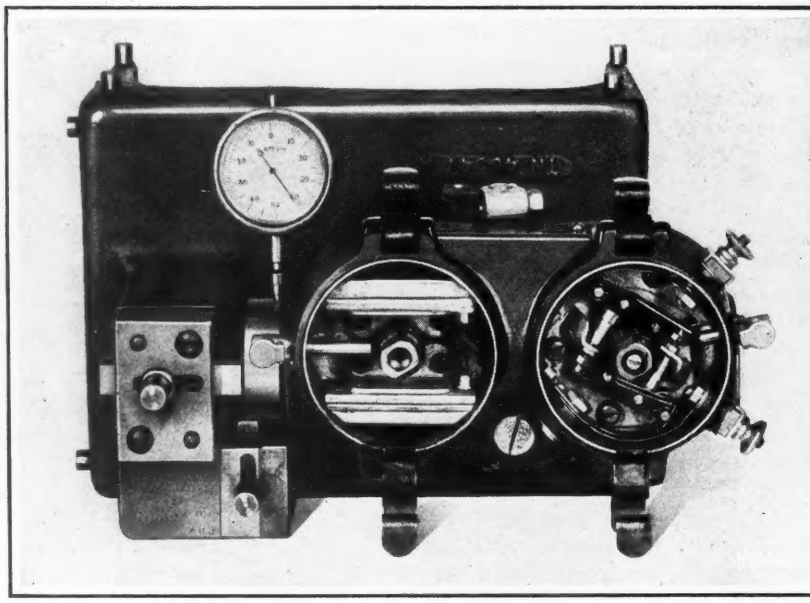


Fig. 7. Fixture on which Ignition Distributors are inspected

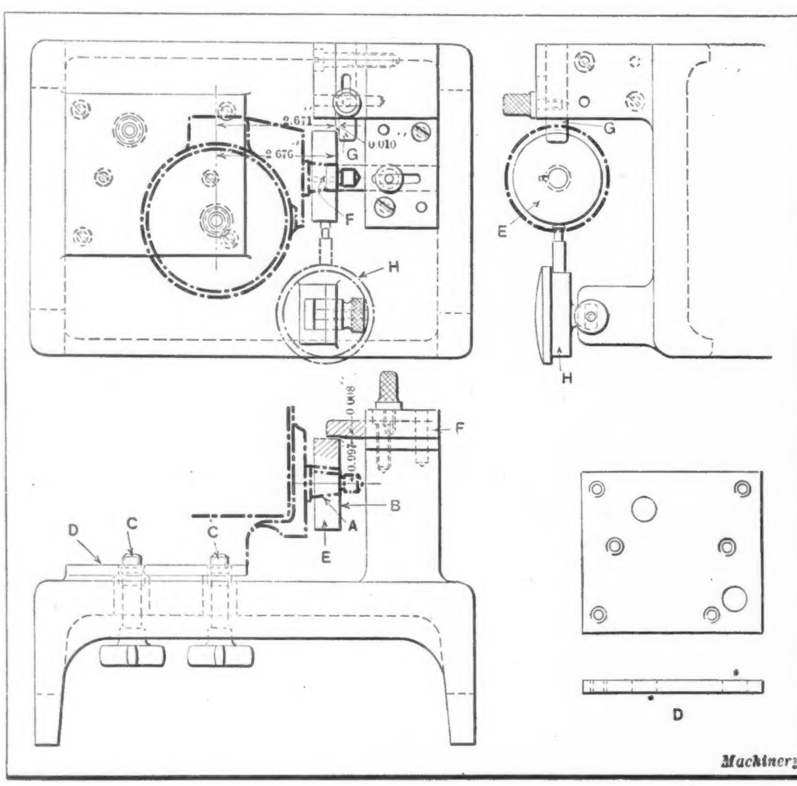


Fig. 8. Detailed View of Gaging Fixture for Ignition Distributors

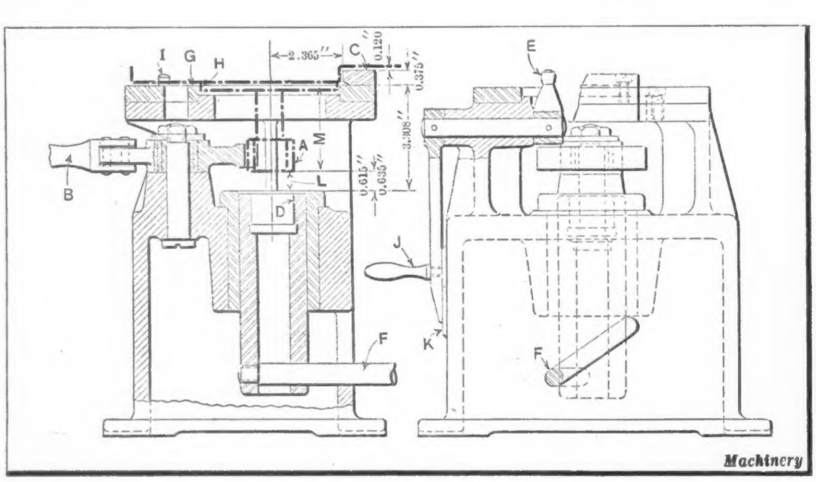


Fig. 9. Sectional View of the Motor Generator Testing Device shown in Fig. 10

Recess Gage for Clutch Shells

Figs. 11 and 12 illustrate a gage used for inspecting the recess at the edge of the clutch shell shown at the left in Fig. 11. The width of the recess is gaged by placing the shell over the gaging points at A and B, in the position indicated. It will be seen that the work is seated against the pins C. The gaging point at B is at the end of a lever, the other end of which actuates an Ames dial indicator, by means of which it is easily determined whether the actual tolerance on the depth of recess is maintained. A snap gage is placed over the gaging points for the purpose of setting the indicator, so that it will read zero when the gaging point B is in the proper relation to the gaging point A. The gage does not indicate whether the error is in the depth or the width of the groove, but whenever the work will seat on pins C and the indicator does not show the right reading, the groove is either too narrow, or its depth is incorrect, or both.

In September MACHINERY a number of additional testing fixtures and gages will be described, including a spring testing fixture, a gage for testing installation conditions of motor generators, amplifying gages, device for testing the spacing of ignition cams, plate gages for the automatic screw machine department, gear-testing devices, limit gages for rollers, etc.

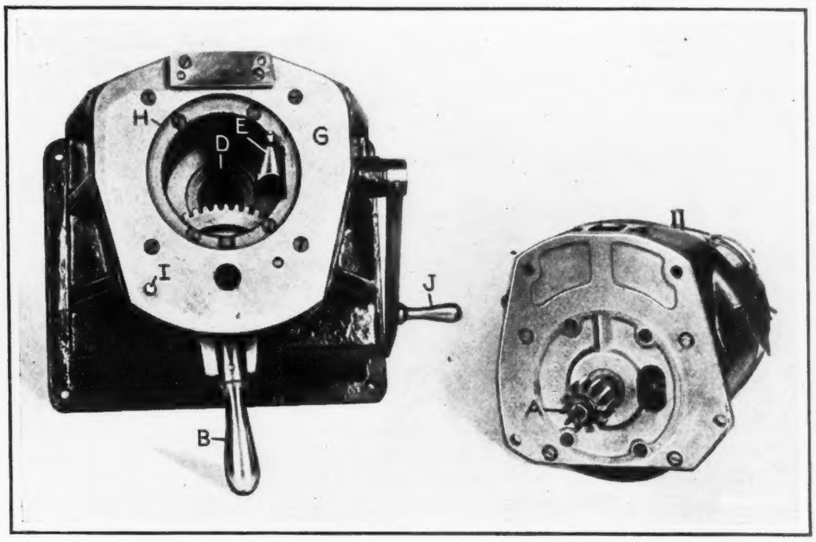


Fig. 10. Functional Gage used in Final Inspection of Motor Generators

INDUSTRIAL INDEX NUMBERS

The Department of Commerce has undertaken to issue monthly index numbers showing the relative changes taking place in a number of financial and industrial activities, which will give an idea of the general industrial activity and the price situation. Instead of giving the statistics in total figures of dollars, tons, etc., comparative index numbers have been prepared which makes it much easier to make instant comparisons. As far as possible the relative numbers have been arrived at by using the average of 1913 as a base number equal to 100; but in many instances the basic data do not go back to the pre-war years, and in such cases the average for 1919 has been used as a base.

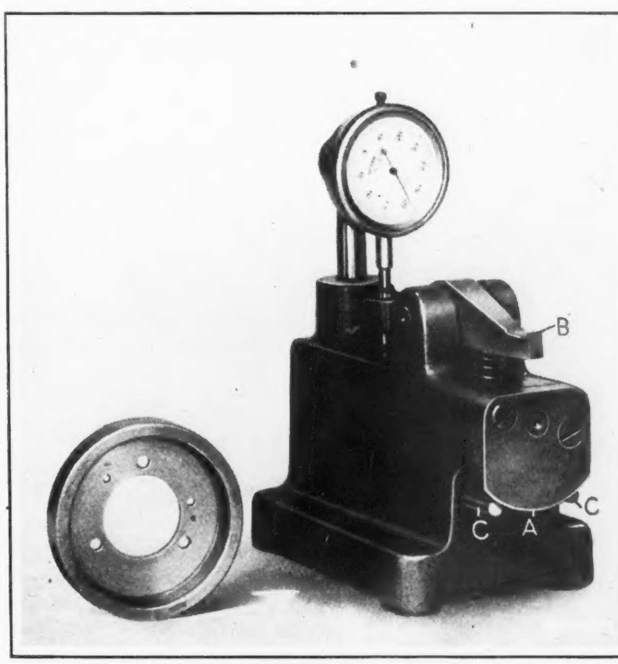


Fig. 11. Gage for checking an Internal Recess

The data that have been published by the Department of Commerce include information relating to banking and financial operations, price index numbers, transportation, foreign trade, farm products and foodstuffs, metals and metal products, textiles, fuels and power, paper, and rubber. A study of these index numbers is very illuminating.

In the price index, for example, comparing with 1913 as 100, it will be seen that the peak for metal and metal products was reached in April, 1920, when prices for these products were 195, while in May, 1921, they were 138. Of the various commodities listed, only the wholesale prices of food and farm products show at present a lower price index number than metals and metal products.

As regards transportation, comparison is made with the 1919 average, because figures for 1913 are not available. These figures show that in May, 1921, the average freight movement was 93 as compared with 100 in 1919. The peak in freight movement was reached in October, 1920, when it was 124. The lowest figure recorded is for January and February, 1921, when it was 85. This shows what a comparatively small margin there is between a feast and a famine for the railroads. With 24 per cent above the 1919 average, the railroads were unable to cope with the traffic. With even 7 per cent below, as in May, they find it impossible to meet their expenses because of the reduced revenues.

The figures for exports and imports show that the exports in May, 1921, were 161 as compared with 100 in 1913, the imports being 139; but in May, 1920, the same figures were 363 and 289, respectively.

The production in the metal and metal products field is well indicated by these index figures. Placing the 1913 average as 100, the pig iron production in October, 1920—the peak month—was 129, falling to 48 in May, 1921; the steel ingot production, which was 131 in March, 1920, fell to 50 in May, 1921. The iron and steel exports reached their peak in January, 1921, at 235, falling to 70 in April, 1921. These index numbers will be published from month to month.

* * *

In a recent Commerce Report it is stated that the Department of Overseas Trade in Great Britain is steadily extending its trade commission service in all of the principal markets, and is keeping exporters well advised of German methods and of trade openings available for British exporters. British wholesale prices are being drastically cut, and the fact is being made wider known by a new scheme of cooperative advertising in the leading newspapers of Australia, France, Japan, India, South Africa, South America, Belgium, Holland, Cuba, Scandinavia, Spain, China, Dutch East Indies, Mexico, and Switzerland. In some cases the advertisements are run parallel with German manufacturers' announcements so that a comparison of prices and of quality can be studied by foreign buyers. Films showing the methods of British manufacture are a notable feature of the new drive that is being made for increased trade.

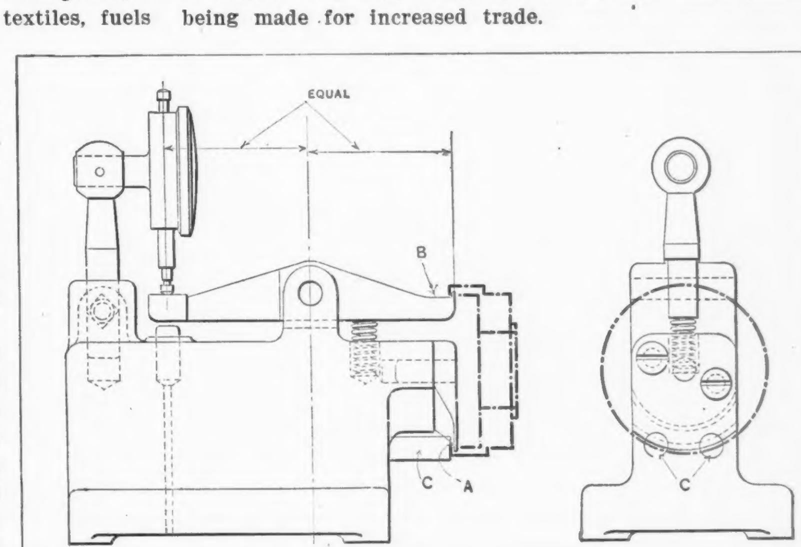


Fig. 12. Position of the Work when inspected with the Gaging Fixture shown in Fig. 11

MILLING A 99-TOOTH SPIRAL GEAR

By GEORGE WARMINGTON

Proper spacing of the teeth in cutting a 99-tooth spiral gear in a milling machine could not be accomplished by simple indexing, and compound and differential indexing were, of course, impossible due to the index-head being connected to the table feed-screw in order to rotate the work to suit the lead of the teeth. The difficulty was overcome by the use of a special templet in connection with a 33-hole circle on an ordinary index-plate. This templet is illustrated in Fig. 1. Thirty-three equally spaced teeth were first cut around the work, then the position of the index-head crank relative to the work was altered by means of the templet, and thirty-three more teeth were cut, after which the crank position was again shifted and the final thirty-three teeth were milled.

In order to space correctly each tooth in the first set milled, the index-head crank was rotated an amount equal to the ratio of the index-head divided by the number of spaces desired. As 40 ÷ 33 = 1 7/33, the crank was turned one complete revolution plus 7 holes, or a total of 40 holes, on the 33-hole circle. After having cut the first set of teeth, in order to mill a tooth one third of the distance between any two, it was necessary to move the crank 1/3 of 40 or 13 1/3 holes. As this was impossible by means of the index-plate alone, the templet previously referred to was employed. The distance between the centers of holes *A* and *B* on this templet is equal to the length of the chord between the centers of any two adjacent holes on the 33-hole circle, and the center of hole *C* is one-third the distance between the centers of holes *A* and *B* when measured along an arc corresponding to that of the 33-hole circle.

After the first set of teeth had been cut, holes *A* and *B* of the templet were placed over the thirteenth and fourteenth holes, respectively, from the one on the index-plate in which the spring plunger of the crank was inserted while cutting the last preceding tooth. Pins were then inserted through holes *A* and *B* into those of the index-plate in order to secure the templet to the latter. The crank was next turned and its plunger inserted in hole *C* of the templet, thus moving the crank the desired 13 1/3 spaces, after

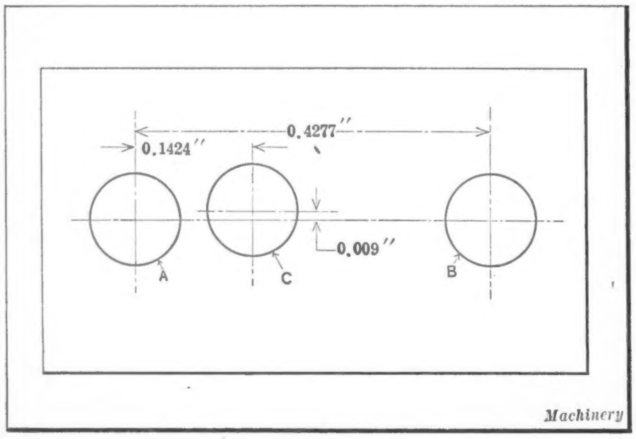


Fig. 1. Templet used with Index-plate for spacing the Teeth in a 99-tooth Spiral Gear

which the two clamping screws on the crank were loosened, the templet removed, and the crank turned to the thirteenth hole, the work, of course, remaining stationary. After the clamping screws of the crank had been retightened, the indexing movements necessary for correctly spacing the next set of teeth were made in the same manner as during the milling of the first set. When the machining of the second set of teeth was completed, the position of the crank relative to the work was again altered in the manner previously described, to permit the final set of teeth to be correctly spaced.

The determination of the various dimensions shown in the templet required trigonometric calculations, as explained in the following, use being made of the diagram illustrated in Fig. 2. The radius of the 33-hole circle of the index-plate was 2.250 inches. It is evident that,

$$COE = \frac{360 \text{ deg.}}{33} = 10 \text{ degrees } 54 \text{ minutes } 33 \text{ seconds}$$

and

$$COD = \frac{COE}{3} = 3 \text{ degrees } 38 \text{ minutes } 11 \text{ seconds}$$

As OK is perpendicular to CE,

$$KOC = \frac{COE}{2} = 5 \text{ degrees } 27 \text{ minutes } 16 \text{ seconds}$$

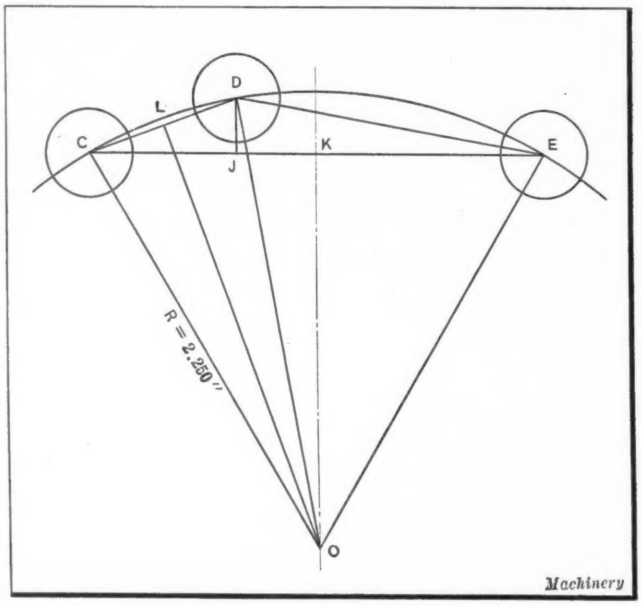


Fig. 2. Diagram used in calculating Dimensions in Fig. 1

Also, as LO is perpendicular to CD,

$$COL = \frac{COD}{2} = 1 \text{ degree } 49 \text{ minutes } 5 \text{ seconds}$$

Finally, DJ is perpendicular to CE. According to geometry,

$$DCJ = COD = 3 \text{ degrees } 38 \text{ minutes } 11 \text{ seconds}$$

Having now determined the magnitude of the various angles involved, the lengths CE, CD, DJ, and CJ can readily be calculated.

$CE = 2R \sin KOC = 2 \times 2.25 \times 0.09506 = 0.4277$ inch
$CD = 2R \sin COL = 2 \times 2.25 \times 0.03172 = 0.1427$ inch
$DJ = CD \sin DCJ = 0.1427 \times 0.06342 = 0.009$ inch
$CJ = CD \cos DCJ = 0.1427 \times 0.99799 = 0.1424$ inch

* * *

PROTECTION OF AMERICAN PATENTS ABROAD

In accordance with the Nolan patent act, foreigners who failed or were unable to protect their inventions by patents in the United States during the war may now do so, provided their governments grant reciprocal privileges to American citizens. The countries which have granted such privileges to American citizens, and in which it is now possible to secure patent protection even after the United States patent has been issued and the inventions publicly used or manufactured or even sold abroad, are Austria, Belgium, Canada, France, Italy, Norway, Sweden, Czecho-Slovakia, Mexico, Spain, and Portugal. American manufacturers are urged to take out foreign patents on their inventions made during the war if they have not already done so in these countries, and if protection there is of value to them. It is expected that legislation to meet the Nolan act will also be passed in Germany, Switzerland, Denmark, Holland, and possibly in Great Britain.

Record of Materials Used in Machine Construction

By HYMAN LEVINE

To secure greater cooperation between its various departments, a certain western plant has developed a commodity book that should be of interest to all firms manufacturing more than one kind of machine. This book contains a list of materials and standard parts used in the construction of its products, and has proved of substantial value, saving much time and expense to the shop, purchasing, cost, and engineering departments, and assisting materially in reducing production costs and overhead expense.

Items are so listed and arranged as to be of the greatest service to all who use the book; and include such raw materials as steel, wrought iron, pipes, brake lining, packing, rubber hose, leather, wool, felt, and paper, and such standard purchasable parts as bolts, screws, nuts, pipe fittings, ball bearings, lubricators, cotter-pins, washers, and rivets. So far as possible, commodities are classified alphabetically, and an index has been added to make the finding of any desired material a comparatively easy matter.

In Fig. 1 is shown page 62 of this book, which lists three sizes of round mild steel ordinarily carried in stock. In the first column is given the part number of the article on which the material is used; in the second column is given, in parentheses, the symbol of the machine on which the part is used; in the third, the name of the part; in the fourth, the number of parts used on each complete machine; and in the fifth, the length of material used in the manufacture of one machine. Thus, the first listing under ⅝-inch diameter mild steel shows that part number IR33-36 is used on the No. IR33 machine as hammer cylinder side-rods, two such rods being required for each machine, and the cutting-off length of each being 19½ inches. The first listing under ¾-inch diameter mild steel shows that the two hammer cylinder side-rods for the No. IR50 machine are made of ¾-inch diameter steel; are cut off 20½ inches long, and bear part number IR5-77. The second listing under ¾-inch diameter mild steel shows that the same rods are also used on the No. IR5 machine. It will be observed on this sheet that although ½-inch diameter mild steel is not used in the manufacture of any machine parts, it is carried in stock for general purposes; and that ⅝-inch diameter mild steel is used for eight different parts, and ¾-inch diameter mild steel for only three. Different sizes, shapes, and characters of steel are similarly listed on other sheets, one of which is shown in Fig. 2.

62

MILD STEEL - ROUNDS

Part No.	For		No. Parts	Length for 1 Machine
		1/2" Dia. Mild Steel		
		Carried in stock		
		5/8" Dia. Mild Steel		
IR33-36	(IR33)	Hammer Cyl. Side Rod	2	39"
IR4 -41	(IR4)	" " " "	2	39"
IR50-155	(IR50)	Throttle Valve Chest Guard	1	36"
IR33-155	(IR33)	" " " "	1	38"
IR5 -155	(IR5)	" " " "	1	38"
IR4 -155	(IR4)	" " " "	1	38"
IRHP-39	(IRHP)	Connecting Rod	1	16"
IRHP-39	(IRHP)	Side Rod	2	25-1/2"
		3/4" Dia. Mild Steel		
IR5 -77	(IR50)	Hammer Cyl. Side Rod	2	41"
IR5 -77	(IR5)	" " " "	2	41"
IR50-82	(IR50)	" " Clamp Bolt	3	37"
IR34-4	(IR34)	Side Rod	2	45"

Fig. 1. A Page from the Commodity Book showing List of Parts made from Round Steel Bars

39 A

COLD ROLL STEEL - HEXAGON

Part No.	For	Name of Part	No. of Parts	Length for 1 Machine
		1/4" Hexagon Steel		
1H-79	(1H)	Wrench for 1H-75	1	5-1/2"
		5/16" Hexagon Steel		
5H-79	(5H)	Wrench for 5H-75	1	7"
6H-79	(6H)	Wrench for 5H-75	1	7"
5H-79	(IRHP)	Wrench for 5H-75	1	7"
		5/8" Hexagon Steel		
IR33-144	(IR33)	Wrench for Valve Chest Plug	1	8-3/16"

Fig. 2. Another Page from the Book giving Information regarding Hexagon Cold-rolled Bars

Standard parts such as bolts, nuts, screws, washers, etc., are not cut to length, but are usually purchased in quantity, and in the listing of these, the last column becomes unnecessary, and may therefore be omitted. Fig. 3 shows page 8 of the book, on which several sizes of hexagon-head cap-screws are recorded. The fifth size given shows ⅝-inch diameter screws, 3¼ inches long, having eleven threads per inch. These are used as cylinder head cap-screws on the 5H and 6H machines, and as clamp bolts on the IRHP machine.

A list of cast-iron castings, arranged in a slightly different manner, is shown in Fig. 4. The usual part numbers, machine symbols, and part names are here given; but there have been added, at the request of the shop and purchasing departments, two blank columns, in which may be written from time to time, the quantity of castings on hand and on order. On other sheets are shown malleable castings, steel castings, brass castings, die castings, and drop-forgings.

When the book was first prepared only four copies were required, and the pages which are of regular 8½ by 11 inch letter page size, were therefore typewritten in quadruplicate. Its usefulness, however, became rapidly apparent, and the demand increased to eight copies. The book is now constructed in a slightly different manner.

The individual pages are typewritten on thin onion-skin paper, a sheet of carbon paper with its face touching the back of the page being inserted in the typewriter so that the impression of the letters appears on both sides of the paper. The pages are then soaked in gasoline to make them more transparent, and two holes are punched at the left of each page for binding, a margin having been left so that these holes will not interfere with the inscriptions.

Eight blueprints are then made of each sheet. The prints are punched at the same points as the original sheets, and are fastened in numerical order under a heavy manilla cover bearing the name of the owner, thus providing a flexible and easily handled book, and a means of ready identifica-

tion. Index sheets are placed at the beginning of the book, and small marked tabs are pasted on the sheets listing the commodities most frequently referred to, thus greatly facilitating the finding of any desired article. The items referred to by the tabs in the engineering department's book are as follows: Square-head bolts, cap-screws, fillister-head screws, set-screws, nuts, pipes and fittings, cold-rolled steel, carbon steel, mild steel, cotter-pins, and washers; but these may be varied to suit the requirements of each department.

How Changes are Made

The continual improvement in product that is sought by all progressive plants frequently necessitates changes in dimensions of parts, the addition of new parts, and the scrapping of old ones. To keep the commodity book up to date, it is therefore necessary to make promptly all corrections to conform with changes in design or shop practice; and to simplify this work was one of the reasons for adopting the loose-leaf blueprint form of book.

When a part becomes obsolete, it is only necessary for the office clerk to collect the books from the various departments, and to cross out the items with a blue pencil; or if a new part is added, it is written in with either white or black ink, making the same change on the original typewritten sheet. When the number of changes becomes too great for this procedure, a new sheet is typewritten, and the prints are inserted in the book. Fig. 2 shows such a sheet. There was originally listed on it only 11/16-inch hexagon steel which was used for making index bars for double-bored gaging blocks, the other parts having been made of mild steel. When it was found that the mild steel did not come close enough to the required dimensions to make the parts suitable for other uses, it was decided to use cold-rolled steel instead. The items were crossed off the sheets listing hexagon mild steel, and a new sheet made out as shown, numbered 39A, and inserted after sheet 39 in the book. A similar illustration is shown in Fig. 4. The castings were not originally included in the book; but when it was decided to insert them, it was only necessary to add a letter after the proper sheet number. Changes, additions, and eliminations are thus made without disarranging the index or the general order of the book.

Hex. Head Cap Screws (Cont.)

		5/8" x 1-1/4" - 11 T. Cap Screws	
IHMP-44	(IHMP)	Upper & Lower Brake Cap Screws	3
IHMP-44	(6H)	Inner Driver Cap Screws	4
IHMP-44	(IHMP)	Sliding Bar Cap Screws (Pedestal type ONLY)	2
		5/8" x 1-1/2" - 11 T. Cap Screws	
IHMP-26	(IHMP)	Sliding Bar Stop Cap Screws	1
		5/8" x 1-3/4" - 11 T. Cap Screws	
IR50-48	(IR50)	Exhaust Flange Screws	2
IR50-3	(IR50)	Base Plate Screws	6
		5/8" x 2-3/4" - 11 T. Cap Screws	
IR5-52	(IR5)	Throttle Valve Handle Clamp Bolt	1
IR5-52	(IR4)	" " " " "	1
		5/8" x 3-1/4" - 11 T. Cap Screws	
5H-72	(5H)	Cylinder Head Cap Screws	18
5H-72	(6H)	" " " "	18
5H-72	(IHMP)	Pedestal Clamp Bolt (Pedestal Type ONLY)	2
		7/8" x 2-1/4" - 9 T. Cap Screws	
IR33-64	(IR33)	Former Clamp Plate Bolt	4

Fig. 3. Page for Standard Sizes of Cap-screws, showing Various Machines on which Each is used

Use of the Book

The use to which the book is put necessarily varies with each department and with the character of the work in progress through the plant; but as occasions arise new uses are found, so that it is now available for many more purposes than was originally intended.

In computing production costs, the charge for material is always an important item. The cost department uses this book to estimate the weights and quantities of materials used in the construction of the various products. Thus, in obtaining the cost of the hammer cylinder side-rods for the No. IR33 machine (Fig. 1), it will be found that 39 inches of ⅝-inch diameter mild steel are used for each machine. The value of this material added to the labor charge and the overhead expense gives the total cost of the parts. On the same machine there are used four ⅞-inch cap-screws, each 2¼ inches long, shown as No. IR33-64, Fig. 3. Being standard purchased parts, and requiring no factory labor, the price of these may be taken from the books direct.

Usefulness of Commodity Book in the Shop

The shop superintendent uses this book for entirely different purposes. Production in the plant being on a schedule basis, it is of vital importance that an ample supply of raw materials be maintained at all times. The items in the commodity book are checked monthly with the quantity on hand and the quantity required by the production schedule;

CASTINGS - CAST IRON

Pattern No.	Used On	Name	No. Req'd.	In Stock	On Order
1H-4	1H,11H,5H	Brake Screw Bearing	1		
1H-5	1H,	Drum	1		
1H-6	1H,11H	Cylinder	1		
1H-7	1H,11H	Gear Frame	1		
1H-8	1H	Center Bearing	1		
1H-9	1H,11H	Gear Cover	1		
1H-10	1H,11H	Cylinder Head	1		
1H-11	1H,11H	Piston	1		
1H-12	1H,11H	Piston Shoe	1		
1H-13	1H,11H	Piston Frame	1		
1H-14	1H,11H	Piston Frame Gib	1		
1H-15	1H,11H	Crank Disk	1		
11H-5	11H	Drum	1		
11H-8	11H	Center Bearing	1		
5H-5	5H	Drum	1		
5H-6	5H,6H	Cylinder	1		
5H-7	5H,6H	Gear Box Frame	1		
5H-8	5H,6H	Center Bearing	1		
5H-9	5H,6H	Gear Box Frame Cover	1		
5H-10	5H,6H	Cylinder Head	1		
5H-11	5H,6H	Piston	1		
5H-13	5H,6H	Piston Frame	1		
5H-14	5H,6H	Piston Frame Gib	1		
6H-5	6H	Tail Rope Drum	1		
6H-43	6H	Haulage Drum	1		

Fig. 4. Record of Castings, Space being provided also for entering Quantities required for a Machine and kept in Stock

thus the possibility of a serious and unexpected shortage is averted.

Should a shortage occur, however, for one reason or another, reference to the commodity book immediately informs the shop what other materials may be used as substitutes. If, for instance, the supply of ⅝- by 1½-inch cap-screws should become exhausted the sheet shown in Fig. 3 would indicate that there is a quantity of cap-screws only ¼-inch longer that is immediately available. If, however, the supply of ⅞- by 2¼-inch cap-screws should become exhausted, the same page would show that there are no cap-screws of near enough size that could be utilized, though possibly, on another sheet, some square-head bolts might be found that would serve the purpose almost as well.

Working drawings usually give only the finished dimensions of the parts, the selection of the stock from which the products are made being left to the shop. By reference to the commodity book, a clerk in the superintendent's office can readily determine what size of material the engineering department intended to have used. The hammer cylinder side-rods No. IR33-36, Fig. 1, are ⅝ inch in diameter when finished, and being made of ⅝-inch diameter steel, require no turning operation to reduce to size.

The book is also of assistance in the utilization of obsolete stock. It happens, occasionally, in the changes of design that are made to meet requirements of working conditions, or for other causes, that certain materials carried in stock can no longer be used for the production of the parts for

which they were intended, due to the changes in these parts. Reference to the commodity book shows the shop office at a glance what other parts there are on which the materials could be used. Thus, if the ⅝- by 1½-inch cap-screws, shown in Fig. 3, should become obsolete, the page shows that they might possibly be used on the No. IRHP machine and the No. 6H machine, where ⅝- by 1¼-inch screws are required.

Advantage of the Book to the Purchasing Agent

The purchasing department is interested in the quantity of supplies on hand and the condition of the market for new supplies. A constant record is kept in the purchasing departments commodity book of all materials on hand and on order, so that it is possible for the purchasing agent to tell, after a moment's inquiry, whether the stock is such that it would pay to wait for a better market before ordering, or whether it is such that new supplies must be bought regardless of price. Large sums of money may occasionally be saved by having available all the facts on the supply at hand, the estimated future demand, and the condition of the market. In these days of fluctuating prices, this is no small item.

A good purchasing agent does not depend entirely on the shop for requisitions on materials. It is quite common for the shop foremen to put off asking for required supplies until the last possible moment; they do not always realize that it takes some time for an order to go through the office, and a much longer time for the order to be filled. If a shortage should occur, the person blamed would be the purchasing agent, and the one to suffer most would be the company. By reference to the figures giving stock on hand, entered in his commodity book, and to the production schedule, the purchasing agent can order the necessary quantities at the proper time, and insure that an ample supply will always be on hand. By the same means he can keep the stock down to a working minimum and save the interest on an unnecessary investment in surplus supplies.

Value to the Engineering Department

The most frequent and perhaps the most advantageous use of this book is made by the engineering department. In any plant that manufactures more than one type and one size of machine, it is of great importance that the same parts be utilized on as many different machines as possible. Such practice saves money in the drawing and designing of parts, in reducing the different sizes of materials that must be carried in stock, and in cutting down the number of machines that are tied up in the production of the parts. Adapting the part for use on a number of machines also saves in the time required to machine each part, due to a better utilization of jigs and fixtures, and in various other ways incident to quantity production.

In designing new machinery, or redesigning old, the engineering department makes constant use of the book for the purpose just mentioned; namely, saving through standardization of parts. Where possible, the identical part is used; and where this object cannot be attained. an effort is made to utilize some size of material already carried in stock, rather than using a new size. The illustrations show to what extent this has succeeded.

In Fig. 1 we find that 9/16-inch and 11/16-inch diameter steel has been entirely eliminated from stock. The ⅝-inch diameter steel, it will be seen, is used for eight different parts, and part No. IR5-77 on two sizes of machines. Fig. 2 shows that part No. 5H-79 is used on three different machines; and Fig. 3 indicates that ⅝- by 1¼-inch cap-screws are used in two machines, in three different capacities. Further reference to this illustration shows other similar instances where the same practice has been followed. Fig. 4 shows a similar condition in castings. Brake screw bearing No. 1H-4 is used on three different sizes of machines: Nos. IH, 11H and 5H; and another machine is now being designed to use the same part. Similar instances in great quantity may be found on nearly every page of the book, and in every design handled by the engineering department.

In the design of tools which are to be built at the plant it is also desirable to use, so far as possible, only those materials and standard parts that are actually carried in stock. It is obviously poor policy to instruct the tool-room to use a ⅞- by 2½-inch set-screw, which it would have to either buy or make, when a ¾- by 2⅜-inch or a 1- by 2⅝-inch screw is carried in stock and would serve the purpose just as well. Neither is there any advantage or economy in specifying a 7/16- by 2⅛-inch steel plate, 3 inches long which would have to be machined to size, when a ½- by 2¼-inch plate, 3 inches long, which is carried in stock and used on a regular machine, would be quite as useful and would require no machining other than cutting from the bar. The commodity book makes it possible for the tool designer to watch these points; and it is in giving careful attention to such items that economies are effected which considerably reduce the investment in tools.

Every growing plant has a certain amount of experimental work and special jobs in process. It is possible by intelligent use of the book to design the parts of such sizes and to use such standard supplies as to reduce the cost of the experimentation materially.

Summary

This commodity book, developed by long experience, and used by many different people, thus adds to the convenience of the force and saves money for the company. Particular credit for its preparation and perfection is due to the chief engineer of the plant and his assistant. As has been indicated, some of the economies obtained are: (1) Reducing the investment in materials carried; (2) cutting the labor required on many parts; (3) producing certain parts in larger quantities; (4) assisting in taking advantage of market conditions thereby making more economical buying possible; (5) eliminating the losses due to shortage of materials; and (6) reducing tool and experimental costs. There are undoubtedly other ways in which the commodity book is and can be used to the advantage of every department and to the entire plant. But enough has been shown to indicate that any firm manufacturing more than one product, that will adopt and use the book, with such changes and modifications as may be necessary to suit local conditions, will be materially benefited thereby. It should be remembered, however, that, to be really valuable, the book must be kept up to date, and free from error.

* * *

HARDENING HIGH-SPEED STEEL WITHOUT PITTING

By WILLIAM C. BETZ

The following method of hardening will be found satisfactory for such tools as milling cutters, forming tools for automatics, and other tools of a similar nature made from high-speed steel, that are required to have smooth unpitted surfaces. First preheat the work in a low-temperature furnace to from 1500 to 1550 degrees F., raising the temperature slowly. Remove to a high-temperature furnace which is heated to from 1950 to 2250 degrees F., according to the hardening heat recommended by the makers of steel, and heat quickly to the hardening temperature. When the hardening temperature is reached, remove the work immediately and quench in a salt bath, heated to from 1200 to 1300 degrees F., consisting of the following ingredients: Calcium chloride, 40 per cent; sodium chloride, 40 per cent; and ferro-cyanide of potassium, 20 per cent. Leave the work in the bath until the steel assumes the temperature stated, then remove and cool in oil at from 350 to 400 degrees F. When removed from this bath, the work should be washed in boiling soda to remove the salt. High-speed steel, heated and treated in this way, will be found to give excellent service, and it will come from the bath clean and unpitted.

DRILL JIG AND TOOL EQUIPMENT FOR MOTOR HOUSING

By H. MIKKELSEN
Tooling Engineer, Bell & Howell Co., Chicago, Ill.

The drill jig and tool equipment here illustrated are employed in the plant of the Bell & Howell Co., Chicago, Ill., in the production of housings for the motor and governor of what is known to the motion picture camera trade as a "cinemotor." The cinemotor parts are manufactured on the interchangeable plan and require an unusually high degree of workmanship and accuracy, the tolerances in some cases being as close as plus or minus 0.0001 inch.

Although the jig and tools shown in Fig. 1 are used only in the production of the cinemotor housing shown at *A*, they should nevertheless prove of general interest to those who are engaged in the manufacture of small interchangeable parts requiring a high degree of accuracy as regards the relative location, and the drilling, reaming, and tapping of holes on different sides of the work. The tool equipment mounted in block *J* is used in machining the holes, and the jig *B* serves to locate the holes in their proper positions, the depths of the holes, counterbores, and threaded sections being governed by the stops mounted in plate *K*.

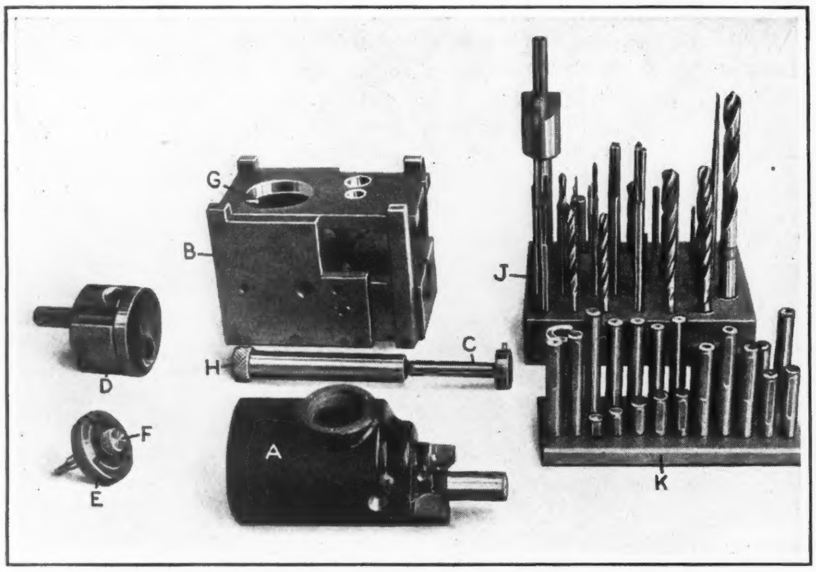


Fig. 1. (A) Cinemotor Housing; (B) Drill Jig for Part A; (J) Block for holding Tools; (K) Plate for holding Depth Stops

Locating and Clamping Work in Fixture

From an inspection of the housing shown at *A*, Fig. 1, it will be evident that the provision of adequate means for locating and clamping the work in the drill jig presents a rather difficult problem, especially when the lightness of the casting and the accuracy required are taken into consideration. The method employed to overcome the difficulties encountered will be more easily understood if an explanation of the procedure followed in loading the jig is given.

The work *A* is inserted at the left-hand end of jig *B*. Fig. 2 shows work *A* in the position that it occupies when clamped in place ready for the various drilling operations which are performed on five of its sides. The right-hand end of the jig is shown in Fig. 3. After the work is placed in the jig as described, draw-screw *C* is inserted at the right-hand end of the jig, and pushed in until the three pins projecting from its head are slid into corresponding slots in the end of the jig as indicated in Fig. 3. The locating plug *D*, Fig. 1, is next inserted loosely in the open end of the work so that it occupies approximately the position indicated in Fig. 2. Locating plug *E* which fits into the large bored hole on the upper side of work *A*, is then inserted in the top plate of the fixture as shown in Figs. 2 and 3. Center screw *F* which projects into a threaded hole in locating plug *D* is next tightened slightly. Pin *G*, Fig. 1, lines up plug *E* and prevents it from turning while screw *F* is being tightened. It should be mentioned that plug *D* is provided with drill bushings for locating four holes inside casting *A*, while plug *E* is equipped with bushings for locating three equally spaced holes in the flange on the upper side of part *A*.

The hole in the top plate of the jig (through which plug *E* is inserted in the work) is elongated, and while it allows plug *E* and the work to be moved a limited distance in a longitudinal direction, or in a direction parallel to the axis of the large bore of the work, it prevents the work from turning or rotating in the jig. Draw-up nut *H* is next inserted through the clearance hole in *D* and tightened on screw *C*, to clamp the work in position. The locating and clamping of the work is completed by tightening screw *F*.

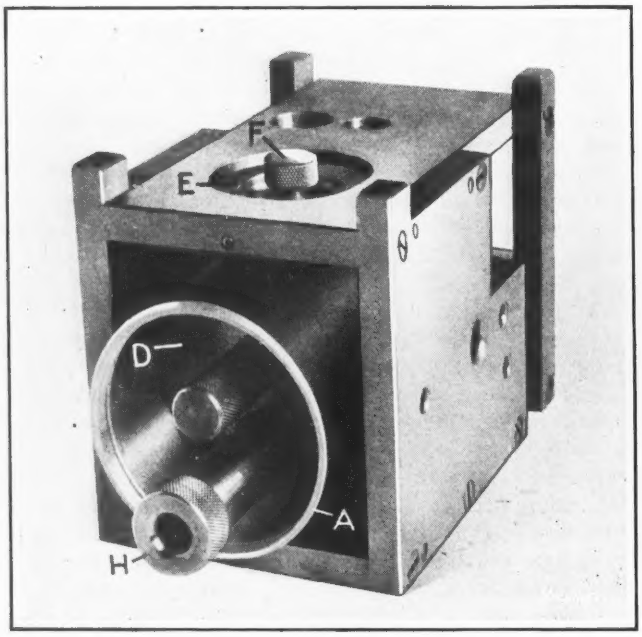


Fig. 2. View showing Open End of Jig with Work in Place

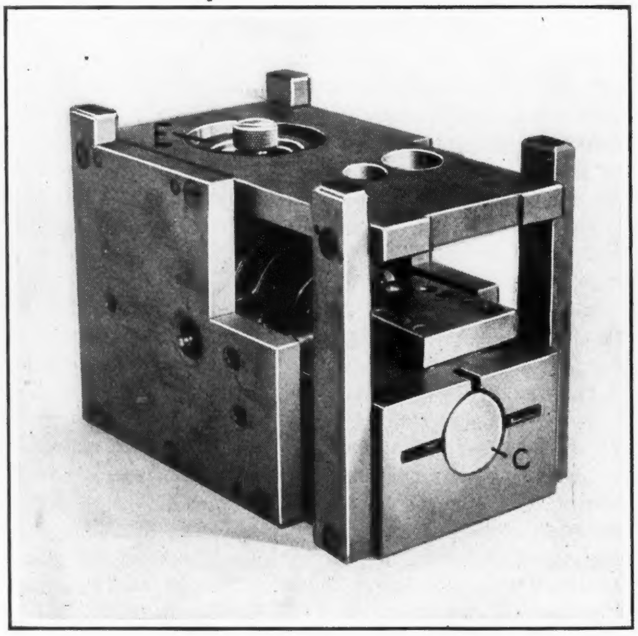


Fig. 3. View showing Closed End of Jig with Work in Place

Tools Used with Fixture

All the tools used in the drilling, reaming, tapping, and counterboring operations are mounted in the order of use in a wooden block as shown in the upper right-hand corner of Fig. 1. In some cases, several tools are used in machining one hole. For holes of this kind several positive stops or tool-setting blocks are required. The limited amount of space on the jig led to the mounting of the stops on a separate steel plate as shown in the lower right-hand corner of Fig. 1. A letter is stamped opposite the drill bushing of each hole requiring the use of a stop or stops in setting the tools. Thus if a bushing marked "A," for instance, is employed to locate a hole in which drilling, tapping, and counterboring operations are required, there will be a corresponding stop for each tool on the gage-plate under the corresponding letter, which in this case would be "A." On each stop is marked the size of the tool with which it is intended to be used, in order to eliminate errors in the selection of tools or stops. The lengths of the stops are determined by adding together the distance from the center of work to the bottom of the hole or counterbore and the distance from the surface plate upon which the jig rests to the center of the work.

* * *

POWER FROM THE TIDES

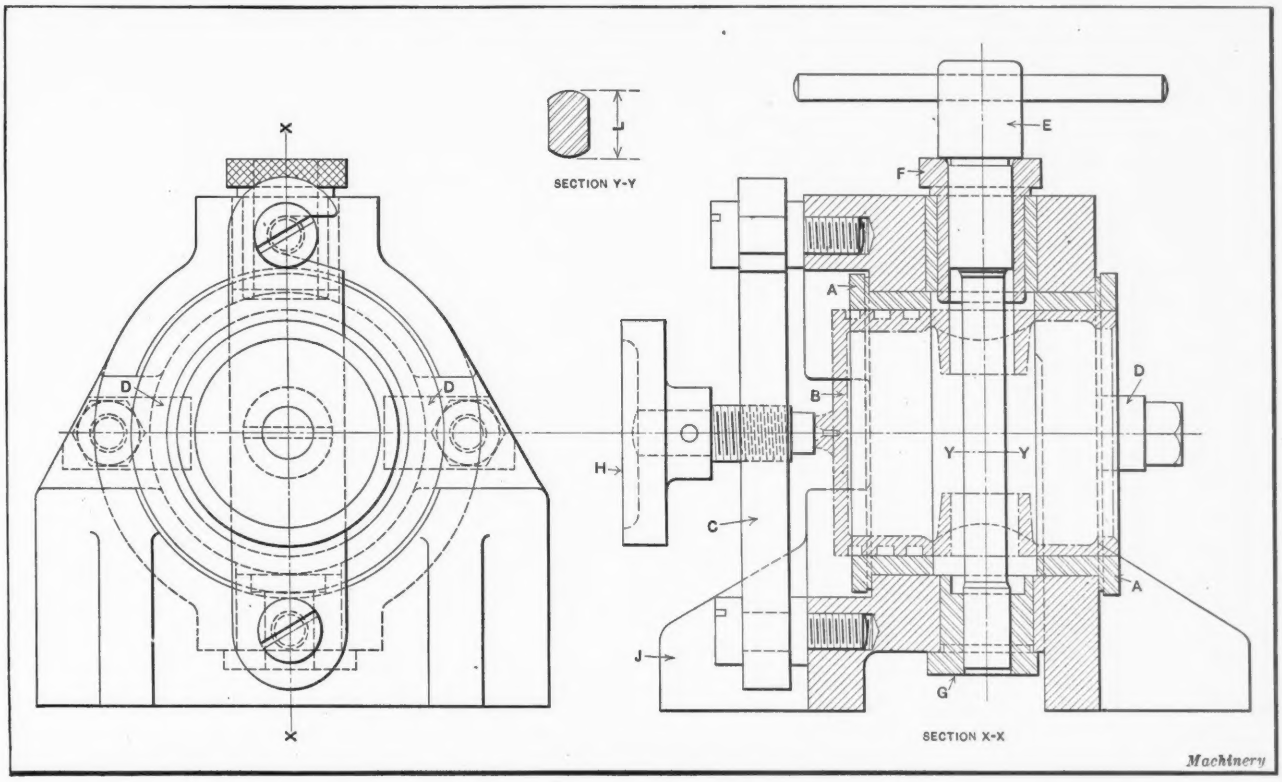
Although the idea of utilizing the rise and fall of the tides for power purposes has long been discussed, no tidal power station of any magnitude has yet been developed in any part of the world. The lack of data based on operating conditions and on constructional costs renders it difficult to form any definite conclusions as to the economic aspects of such a scheme. Much interest is, however, being shown in this question by government committees in Great Britain and in France. It is reported that experiments are to be carried out in the latter country, and it is probable that definite data will be available in the near future. The only practicable methods of developing tidal power on any large scale are based on the use of one or more tidal basins, separated from the sea by dams or barrages, and of hydraulic turbines through which the water flows on its way between the basin and the sea, or between one basin and another.

FIXTURE FOR LINE-REAMING WRIST-PIN HOLES IN PISTONS

By WILLIAM OWEN

In the production of automobile engine pistons it is necessary that the wrist-pin holes be accurately reamed to size and that they also be accurately centered and lined up at right angles with the sides of the piston. The fixture shown in the accompanying illustration is designed for use in performing this reaming operation. It is provided with a set of interchangeable work-holding bushings *A* which are a press fit in the fixture. This construction permits pistons of standard size as well as over-size pistons to be reamed in the fixture by simply changing the bushings. The pistons must, of course, be ground or finished accurately to size so that they will be a good fit in bushings *A*, before the wrist-pin holes are reamed.

In loading the fixture, clamp *C* is first swung aside and the piston inserted so that the skirt or open end comes in contact with stops *D* attached to the end of the fixture. The locating pin *E* is next inserted and passed through the guide bushing *F* and the drilled wrist-pin holes of the piston until the small pilot at the end enters bushing *G*, thus locating the wrist-pin hole in the correct position for reaming. Clamp *C* is then swung into place, and the end of the screw *H* brought against the head of the piston *B* to hold it in position while reaming; locating pin *E* is next removed and the reamer inserted and run through the work.



Line-reaming Fixture for reaming Wrist-pin Holes in Pistons

The body *J* of the jig is of cast iron and is provided with legs set wide apart to insure accuracy. The locating pin is made a snug fit in the upper and lower guide bushings, but in the center where it passes through the wrist-pin holes it is flattened on the sides as shown in section *Y-Y*, dimension *L* being made a good fit in the drilled wrist-pin hole. This style of pin allows the work to be located or clamped against the open or skirt end, yet it locates the wrist-pin hole in the correct vertical and central position. The reamer employed is of the two- or four-blade built-up type having a pilot at the lower end which runs in guide bushing *G* and a body which runs in the upper guide bushing *F*. The driving end of the reamer is made with a taper shank but it can, of course, be made to fit the collet of a quick-change drill chuck.

Working Sheet Aluminum

By A. EYLES, Foreman Sheet Metal Worker, Lancashire & Yorkshire Railway Co., Manchester, England

MUCH has been written recently about the physical characteristics of aluminum, but comparatively little has been published from the mechanic's point of view, notwithstanding the fact that this metal is now being increasingly used and has become an essential material in many industries. The present article, therefore, being written by one who has been engaged in the art of working sheet aluminum for a number of years, should contain something of practical value and general interest.

Comparatively speaking, the art of working aluminum is in its infancy. The fundamental advantage obtained by the use of aluminum is naturally that of lightness, since in cast form it has a specific gravity of only 2.56 or about one-third that of iron or steel. The strength and weight of some of the more common metals used in the manufacture of sheet metal ware are given in the accompanying table.

Aluminum is one of the most malleable of all industrial metals, being surpassed only by gold and silver. As regards ductility, it is sixth in order, being preceded by gold, silver, platinum, copper, and iron. The malleability and ductility of the metal are such that it can be rolled into sheets less than six ten-thousandths inch in thickness and then beaten into leaves twenty-five millionths inch thick, provided of course, that the working of the metal is accompanied by frequent annealings. Soft aluminum sheets can be spun and formed by various methods into all shapes. In fact, it may be safely stated that aluminum can be drawn deeper and with less annealing than the other commercial metals, if the proper grade is used with a suitable lubricant. For drawing aluminum, a cheap grade of vaseline is used as a lubricant, and for drawing deep shells, lard oil is commonly applied. Kerosene is recommended as a lubricant for performing stamping operations or for shallow draw-press work.

COMPARISON OF STRENGTH AND WEIGHT OF METALS USED IN SHEET-METAL WARE

Metal	Specific Gravity	Weight in Pounds		Ultimate Tensile Strength, Tons per Square Inch
		Per Cubic Inch	Per Cubic Foot	
Aluminum (Cast)...	2.56	0.092	159	5.25
Aluminum (Sheet)..	2.70	0.097	168	7.50
Zinc (Sheet)........	7.20	0.259	448	7.00
Copper (Sheet)......	8.80	0.318	549	13.50
Iron (Sheet)........	7.70	0.278	480	23.00
Steel (Sheet)........	7.80	0.282	486	28.00

Machinery

Care in Selecting the Proper Grade of Sheet Metal

When ordering aluminum sheets, it is necessary, if the requirements of the job are at all exacting, to specify the temper desired, because the sheets can be obtained in various grades of hardness, ranging from dead soft to dead hard. Care should also be exercised to specify the sizes best adapted to the purpose for which they are to be used. The degree of hardness of metal sheet, depends, of course, on the amount of rolling that it receives at the mill, and also upon the number of annealings it receives during the rolling process. If worked too long without annealing, aluminum will become so hard that it will be brittle.

For convenience in ordering, three grades of hardness are usually specified: (1) dead soft, which has been annealed and which is suitable for much forming and working; (2) half hard, which has been annealed during the rolling and which is suitable for plain stamping and a limited amount of working; (3) dead hard, which is not annealed and which is suitable for bending and straight work that does not require working. The difficulty now being encountered in obtaining certain kinds of wood for motor and railway coach construction, and the comparative ease with which aluminum sheets of large size and without blemish can be obtained, is leading to the more general use of aluminum in the motor and railway shops. As an illustration of the sizes which may be obtained, the writer has recently worked on aluminum sheets having a surface area of 77 square feet, being 14 feet long by 5 feet 6 inches wide, and having a thickness of 3/32 inch. This large sheet was used in the construction of all-metal railway vehicles.

Care in Handling the Metal

In the various operations by means of which the sheet aluminum is fabricated into numerous shapes, over-working or over-straining of the metal should be avoided. This condition is often due to working the metal excessively without exercising suitable judgment with regard to the annealing operations. Working sheet aluminum to a cracking or splitting point indicates lack of annealing and injudicious workmanship. It is always advisable to anneal the metal often rather than risk fracturing it before the shaping operation has been completed. It should be remembered that during the forming operation the structure of the metal is entirely disarranged, as is graphically illustrated when a perforated spherical cup which has been worked up from the flat, is examined. Some of the perforations, it will be seen, are enlarged, while others are contracted, according to the flow of metal. Deep shells requiring a number of drawing operations, should be annealed during the process as soon as the metal shows a certain degree of hardness. In such a case, two or more annealings are often required.

Hollowing, raising, or other forming operations are accomplished in different ways and with different results by the metal-worker and by the power-press operator. The sheet-metal worker easily hammers a sheet of aluminum or copper into the desired shape and produces a shell without seams or joints. The same shell may be produced on the power press and the finished product will contain perhaps a number of joints, but in this case the amount of hollowing or "dishing" required on the aluminum sheet is considerably less. Also it may appear as though it would be easy to hollow or raise a sheet of metal to any extent if the operation is performed with the metal hot, but such is not the case, especially with brass and copper. Iron can be worked much better when hot, and sometimes sheet aluminum can be more easily manipulated when heated to about 200 degrees F.

In all cases where aluminum is subjected to severe treatment, accompanied by displacement of its fibers, careful annealing is necessary in order to insure the equal flow of the metal and minimize the possibility of cracking. There is no exception to this rule, either for thin or thick sheets.

Determining Sizes for Drawn Shells

To lay out accurately a pattern to be cut from aluminum sheet metal, that is subsequently to be drawn to shape, particularly if the surface has a spherical or compound curvature, is an operation requiring something more than

guesswork. In practice, however, very good approximations can nearly always be found. One method commonly employed in finding the blank size for a drawn cylindrical sheet aluminum shell is to multiply the circumference of the cylindrical article by its height and add the area of the bottom. This formula gives the diameter of a circle of equal area, and does not allow for flange; consequently the proper allowances should be made. In calculating the blank diameter for a spherical or hemispherical shell, it is assumed in the formulas used that the area of the circular piece of metal is equal to the curved surface of a hemisphere. This assumption is practically correct, and would be strictly so if the metal of the finished articles were exactly the same gage as the sheet from which the blank is cut. To maintain the same thickness of metal is extremely difficult in practice; but what is lost in area by contraction is compensated for usually by what is gained in expansion while working it to shape. The following formula may be used to find the area of the blank of a hemispherical shell. Since the area of a hemispherical surface is equal to $\frac{1}{2} \times \pi D^2$, the radius R of the circular blank corresponding to this area may be written thus:

$$R^2\pi = \frac{D^2\pi}{2}; \text{ or } R^2 = \frac{D^2}{2}$$

and

$$R = \frac{D}{1.4}$$

It will thus be seen that the radius R of the blank can be found by simply dividing the diameter D of the sphere having the same radius as the hemisphere, by 1.4.

Another well-known and simple method of finding the blank size, when a sample article is available, is by weight. The sample is first weighed, and in determining the size care should be exercised to use the same thickness of metal. If, for example, the article weighs exactly one pound and is made from sheet aluminum 0.064 inch thick, the first step will be to find the weight of a square foot of metal from the value given in the accompanying table. It will be found that 1 square foot (or 144 square inches) weighs 0.894 pound; consequently the area which will weigh one pound can be found by dividing 144 by 0.894, which gives 161.14 square inches, or a blank diameter of nearly 14 3/8 inches.

Annealing Methods

Correct annealing is dependent upon two factors, time and temperature. Oftentimes the varying of the annealing period has a more important bearing on the mechanical properties of the metals than has the temperature. Although aluminum is distinctly a malleable metal, it frequently is necessary to anneal it two or three times during the forming of an intricate piece. The procedure is to work the piece to

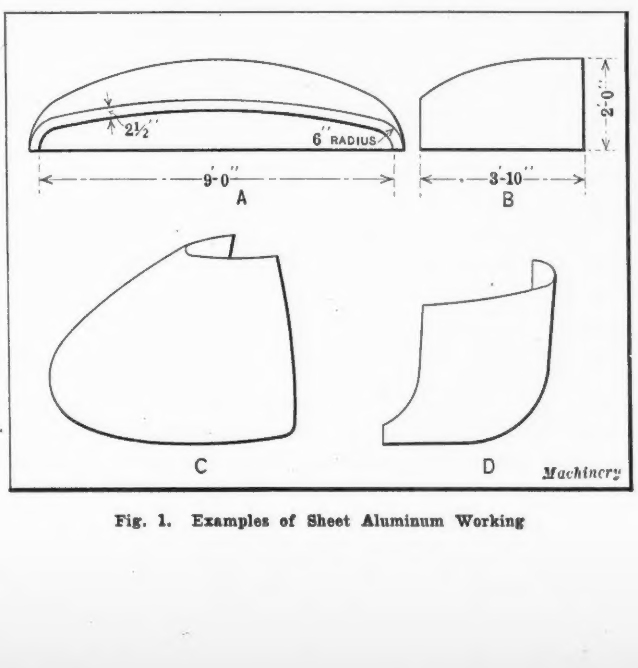


Fig. 1. Examples of Sheet Aluminum Working

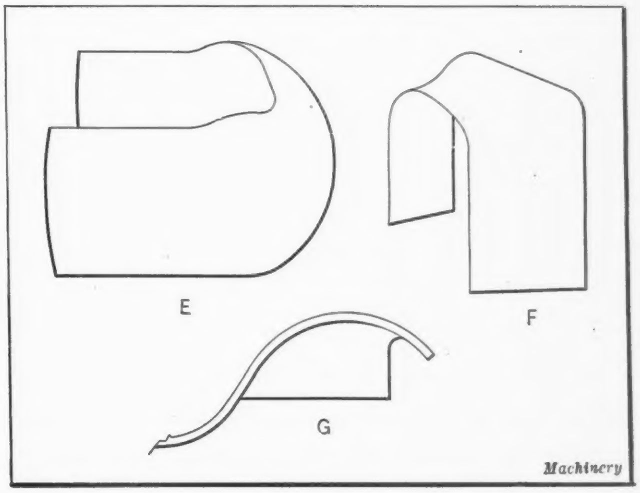


Fig. 2. Additional Aluminum Parts for Automobile Construction

a certain stage, anneal it, and repeat the process until the desired shape is obtained.

Sheet aluminum can be most efficiently annealed in a muffle furnace, where the heat can be obtained by radiation. If such a furnace is not available, the work may be annealed quite satisfactorily in an open fire of clean coke, over a brazier's gas hearth, or over the flame of the benzoline or gasoline blow-torch. Owing to the relatively low melting point of aluminum, which is approximately 1210 degrees F., great care must be taken during annealing to prevent the metal from melting. The correct temperature varies from 700 to 900 degrees F., depending on the thickness of the metal and the length of time that it is subjected to the heat. Cold-rolled sheet aluminum is often annealed by prolonged exposure at various temperatures; for example, an anneal will be obtained by a twenty-four-hour exposure at 698 degrees F. for a certain grade of metal. On the other hand, perfect malleability of the metal is often restored on cold-rolled aluminum sheets by exposing them for three minutes at the annealing temperature of 887 degrees F. Tests have shown that short exposures in the annealing temperature, ranging from three to thirty minutes, confer workable properties on the metal. The following three simple methods may be used for annealing sheet aluminum:

1. Prepare a mixture of ordinary whiting and oil, mixed to the consistency of thick paste. Coat the metal on both sides with this preparation, and place it on a clean fire or in a furnace, allowing it to remain until the oil in the paste becomes ignited. When this occurs withdraw the work from the furnace and allow it to cool gradually. The coating of whiting should then be removed from the surface of the metal by washing it and brushing.

2. Heat the metal to a dull red color, perceptible in the dark and cool slowly. With this method care must be exercised to get an equal annealing temperature distributed over the entire surface of the work.

3. Heat the sheet aluminum until pine wood sawdust just glows when sprinkled on it, which indicates a temperature of about 750 degrees F. At this temperature a dry match-stick will just char when rubbed on the metal.

With any annealing, it should be emphasized that it is of the utmost importance to see that every part of the work reaches the necessary temperature; otherwise strains will exist in certain parts of the metal which will not be relieved by the annealing process. Sheet aluminum can be thoroughly annealed by cooling slowly in the atmosphere, or by cooling quickly by plunging into clean cold water. An advantage gained when the work is cooled quickly in water is that further stages of working the metal can be taken up without delay, instead of waiting for the metal to cool gradually, and the former method is preferred by some workmen.

Examples of Aluminum Sheet Working

Figs. 1 and 2 show examples of sheet-metal working, which have been recently handled by the writer. At *A* and *B*, Fig. 1, are shown two views of a canopy for all-metal railway cars. The thickness of metal is 0,080 inch, and the dimensions indicate clearly some unusual characteristics about the job which required careful manipulation of the metal in order to produce the first-class product which was essential. The metal was cut to the desired shape, which was determined by previously making a model. The size of sheet required was 11 feet 8 inches by 4 feet 9 inches. The metal was first shaped by hollowing or raising it on a concave wood block. The flange was worked over to a depth of 2½ inches, as the diagram at *A* shows. The flanging operation presented some difficulty, especially at the ends, where the 6-inch radius is shown, because here there was great danger of cracking or splitting the metal. To secure a smooth surface and to harden and stiffen the canopy, the work was finished off with a planishing hammer while laid on a smooth convex head.

The specimen of sheet aluminum work shown at *C* is a cowl for an airplane engine. In the manufacture of aircraft, the use of sheet aluminum for cowlings, etc., is of extreme value, owing to the ease with which the metal can be shaped and its lightness. The piece of work shown at *D*, which is a corner panel for a motor car, is a rather difficult part to handle, due to the compound curve.

The example of aluminum sheet working shown at *E*, Fig. 2, is that of the back panel of the motor car which extends from door to door in one piece. The desired contour was obtained by forming the metal with the hammer, from a single sheet of aluminum placed over a large concave block of wood. When the shape of these automobile backs is particularly bulbous, it may be made in halves and welded together by the use of the oxy-acetylene torch. By this method a joint can be made which is as strong as the rest of the material and which is practically invisible. At *F* there is shown an ogee cowl-dash for a motor car which is made by first cutting the metal to the required developed area and then working it by "raising-in" and "raising-out" methods to form the ogee, or compound curve design. The other specimen, shown at *G*, is a typical splash or mud guard with wing, used on motor cars.

Suggestions for Working Sheet Aluminum

In all the examples shown in these two illustrations, the shaping should start on a concave block or leather sand bag, working from the edge of the blank toward the center in a series of concentric circles and using a round-nosed wooden mallet. The shape of the work should not be developed too rapidly in any one section, for if the metal is stretched too much in one direction, it is very difficult to get it back again where it can be properly re-formed. It is advisable to work the metal by applying many light blows in preference to a few heavy ones. This procedure will result in the work being finished quicker than by the use of heavy blows. The shape of the article should be gradually developed at each stage of the hammering. As the metal hardens by working a hollowing hammer should be used, working outward and removing the wrinkles or ridges that may have been produced.

It is good practice to test the work before the finished shape is fully reached by placing it on the car frame, which will immediately indicate whether or not alterations are necessary. As soon as it has been established that no alterations are required, the metal should be planished on a convex head, made of iron or steel, using a suitable hammer and working from the center to the outside edge. The final smoothing may be accomplished by using a hammer, the head of which has been covered with thin leather, but in delivering the blows they should be directed to fall between those previously delivered. This process should be continued until the surface of the metal is quite smooth.

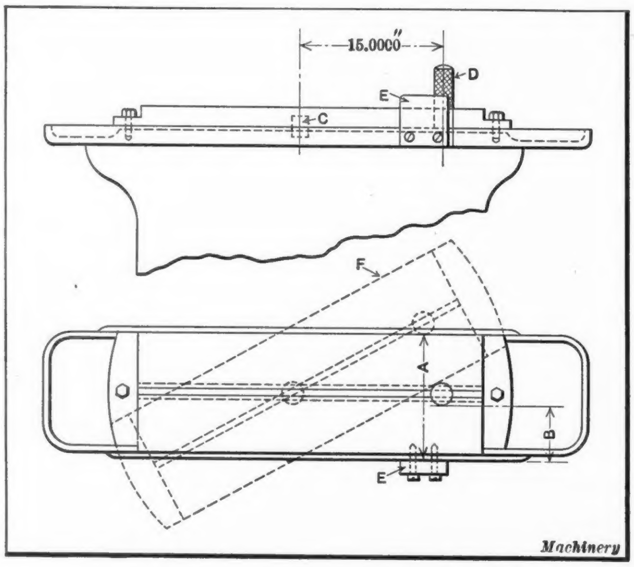
Hand planishing may be advantageously replaced by using a power-driven hammer, delivering hundreds of blows per minute. It is possible when working sheet aluminum to so finish the surface of the metal that no marks will be perceptible on the surface. A slight unevenness of the surface after planishing may be smoothed out by using a piece of emery cloth glued to a piece of wood. This also leaves the surface of the aluminum in a suitable condition for receiving the paint. Aluminum takes paint or enamel excellently, and such troubles as blistering or cracking are rarely encountered in sheet aluminum panels and similar formed parts.

* * *

SETTING TABLE FOR TAPER GRINDING BY SINE BAR METHOD

By W. E. WILSON

In grinding taper plug gages the writer has found it convenient to use the top half of the grinding machine table as a sine bar when setting the table to give the required taper per foot. The accompanying illustration shows how the



Grinding Machine Table used as Sine Bar

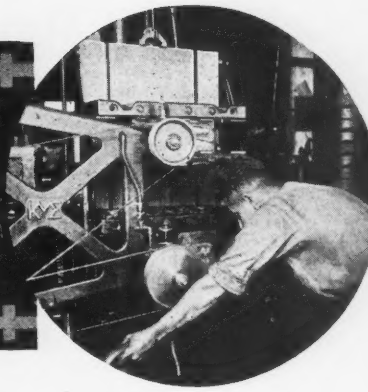
grinding machine table is equipped for this method of setting. A 1⅛-inch hole is bored in the top half of the table at a distance of 15 inches from the center of pin *C*, about which the table pivots. A hardened and ground plug *D* is provided which fits into this hole. A hardened, ground, and lapped block *E* is also attached to the lower half of the table.

Now the distance from the center of pin *C* to the center of pin *D* is known, and the distance *B* between plug *D* and the lapped face of block *E* (when the table is set for straight cylindrical grinding) can be easily measured. With these measurements given, it is evident that standard size blocks can be employed to set the top half of the table at any desired angle, in much the same way as in setting a regular sine bar. The dotted lines at *F* in the lower view show the position of the top half of the table when set for grinding a steep taper. In setting the table in this position, standard size blocks would be placed between plate *E* and pin *D* to give the required distance *A*, which would be calculated by trigonometry in the usual way.

* * *

Manufacturers who are interested in the housing problem as it affects their employes should find the copy of an address delivered before the American Institute of Architects at Washington, and appearing in the Commerce Report of May 13 of special interest, as it outlines a method whereby the Department of Commerce can render cooperation in the national housing problem.

Design and Making of Drop-forging Dies



Methods Employed in Modern Drop-forging Plants—First of Two Articles

A DROP-FORGING die consists of two blocks of metal, usually steel, in the face of each of which the impression of one half the forging to be produced is cut. One of these members is attached to the ram of the drop-hammer by a dovetail shank *A*, Fig. 1, machined in its upper surface, and the other is similarly mounted and secured on the sow block or anvil cap. Matching surfaces *B* are provided for aligning the upper and lower dies, so that the impressions will match, and if this is not done accurately, the forging will be ruined, regardless of the accuracy with which the impressions have been made.

Material for Drop-forging Dies

The material from which drop-forging dies are made is usually either a high-grade open-hearth carbon steel or an electric alloy steel containing certain percentages of nickel and chromium, although other alloys are used in special cases. This special chrome-nickel steel has been found particularly suitable for producing drop-forgings from a higher grade of material than was formerly thought possible to drop-forge successfully. The development in this regard has been due primarily to the demands of the automobile industry, in which there are used a great variety of intricately shaped drop-forged parts made from dense fine-grained alloy steels of various compositions. Straight carbon steel, which is the material used extensively for certain types of drop-forging dies, has inherent advantages which make its use generally preferable to alloy steel for the smaller classes of work.

Cast-steel and Cast-iron Dies

Cast-steel dies are sometimes used, but care must be exercised in selecting the steel, to insure that the casting is sound and free from blow-holes. The advantage of casting the die impressions over sinking them is in the saving of time in manufacture, and more especially in the possibility of producing more intricate shapes. Cast-steel die-blocks are not recommended, however, unless the design of the forging demands that the impressions be cast. On the lighter classes of drop-forgings, particularly if there are only a few to be made from one impression, cast-iron die-blocks have been used with fair success. The finest grain of cast iron should be used in making drop-forging dies, and the structure of the iron should be homogeneous.

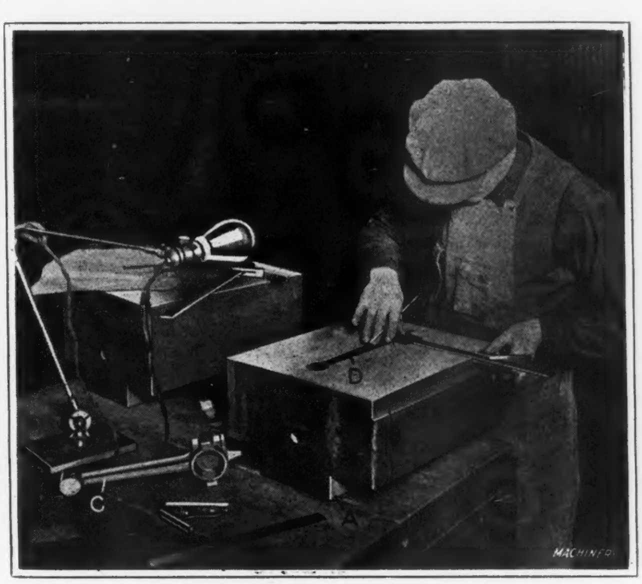


Fig. 1. Laying out Die Impression with Aid of Templet and Side Matching Surface

Comparison of Carbon and Alloy Steels for Drop-forging Dies

Although mention has been made of the use of cast-steel die-blocks and those made from cast iron, there are a great many shops in which neither of these is used. In fact, when one speaks of die-blocks, forged steel is usually understood to be the material used. Forged steel die-blocks are made from large ingots in the steel mills and have usually been annealed and frequently heat-treated, according to the requirements of the user, when received in the drop-forge plant.

In one shop where both carbon and alloy steel blocks are used, the practice is to use carbon steel blocks in the annealed state, and after sinking the impression, to harden them according to the specifications furnished by the steel manufacturer. The alloy steel blocks are received in a heat-treated state, and register a scleroscope hardness of about 50. These blocks receive no heat-treatment after they come to the drop-forging plant, but are machined direct and put into immediate service. The scleroscope hardness which these alloy blocks have been drawn to is the maximum for machineability, but the service to which these particular dies are put does not require a high degree of hardness so much as it does toughness, so that alloy steel of the hardness mentioned is suitable in this case. It is doubtful, however, whether anything is gained by receiving the blocks at the drop-forging plant in a heat-treated state, for the most satisfactory procedure seems to be to work the steel blocks, whether they are carbon or alloy, while they are soft, and to heat-treat them after the impressions have been sunk.

Desirable Qualities for Die Steels

The desired qualities for die steels are sufficient hardness to prevent spreading from the wedging of the hot metal in the impression, and enough toughness to withstand the destructive effect produced by the hammer blows. Obviously, deep-impression dies are the ones which will cause trouble by spreading, unless the proper grade of steel is used. Steel with the desired physical properties usually contains carbon, manganese, nickel, and chromium. For special uses, alloy steels containing vanadium, cobalt, tungsten, and molybdenum are also suitable. A straight carbon steel is not wholly suitable; neither is a low-carbon steel, high in manganese, although both are often used.

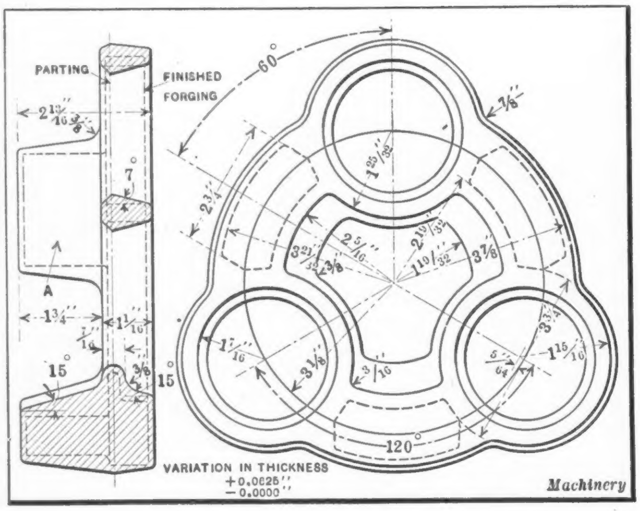


Fig. 2. Forge-size Drawing with Draft, Finish, and Shrinkage Allowances

Selecting the Proper Kind of Die Steel

Too much care cannot be exercised in the selection of the die steel. It should be made by either the electric process or by the acid open-hearth method. A very satisfactory carbon steel, and one which is quite generally used where the tougher alloy steel is not required, contains 0.60 per cent carbon and 0.70 per cent manganese, with small quantities of sulphur and phosphorus. This gives the proper degree of toughness, and is generally suitable since it does not spread perceptibly under the hammer. A chrome-nickel alloy steel which, after much experimentation by steel manufacturers, has proved to be excellent for drop-forging dies, has the following composition: Carbon, 0.55; manganese, 0.70; nickel, 1.5; and chromium, 0.50 per cent, with about 0.04 per cent, each, phosphorus and sulphur.

The selection of the steel to use for a particular drop-forging die requires the exercise of sound judgment based on long experience. Although a number of rules have been formulated, any general rule which might be stated, cannot be implicitly followed. It is known that alloy steel dies will not check as readily as those made from carbon steel; it is also known that carbon steel wears longer on small forgings of thin section than does an alloy steel die. Checks, or small cracks appearing in the impression produced by the heat of the forging, gradually become larger and more pronounced as the dies are used, and these form corresponding projecting fins on the work. These fins are objectionable, not only because they give the piece a rough appearance, but also because they make it difficult to locate the forging in a jig or fixture for machining.

If the forging is of such design that there is considerably more metal in any one part than in the rest of the piece, as for example, in the hub of a gear or a projecting boss, especially if the die impressions are deep, alloy steel is the material to use in making the dies. When the forgings are of thin section, carbon steel blocks are invariably used, on account of their being fully suitable in service and more thoroughly understood by the hardener. Carbon steel is also cheaper than alloy steel.

The size of the die-block is another consideration which is of great importance. If large quantities of drop-forgings are to be made, it would appear that carbon steel, on account of its better wearing qualities, would be more suitable, but if the design of the drop-forging is such that the metal must be broken down and shaped quickly in one operation and without a great number of blows being struck (even if the piece is comparatively small), alloy steel dies will withstand the severe blows of the hammer better than dies made from carbon steel. This, of course, requires a more substantial block and should be considered before work of making the die impressions is started.

Ordinary low-carbon steel, made either by the Bessemer, open-hearth or crucible process, fills the die impressions and crevices readily and is an excellent forging material, but due to later developments in automotive industries and in the fabrication of airplane engine parts, the denser alloy steels are being commonly used. Chrome-nickel steel is one of the most difficult of these alloys to forge, and in designing the dies for forgings made of this material, the impressions should contain no sharp corners and crevices, but these parts should be well rounded and filleted.

Importance of Adequate Draft, Shrinkage, and Machining Allowances

After the proper size and composition of die-block has been decided on, the method of laying out the impression and sinking it is a comparatively simple matter. Before this can be done, however, the consideration of draft allowance, shrinkage, and allowance for machining, must be made. The usual draft allowance is 7 degrees, but this is sometimes increased to 10 or even 15 degrees if the depth of the impression and the general design should require it. In deep, narrow, die impressions or where the metal must be "shot up," that is, forced into the impression in the upper die, an increase in draft allowance is necessary.

Another instance in which increased draft must be allowed is where there are holes or openings in a forging, especially if the walls are of rather thin section. Holes are produced by plugs in the matched dies, and these plugs are of such a height that there is a thin, horizontal wall left in the forging at the parting line within the hole, which is subsequently punched out. The draft on these plugs is often as great as 15 degrees, the reason being that on account of the thin-section walls the metal shrinks rapidly during the process of forging, and so is likely to contract sufficiently to "freeze" to the die plugs. In drop-forging a part of the design referred to, the draft on the outside of the impression would not need to be more than the standard 7 degrees, or just enough to permit the forging to be readily withdrawn from the impression.

On smaller work the draft is sometimes as small as 3 degrees, and it is also as small as this on large work if the section is thin and the impression shallow. The failure to provide sufficient draft will result in the die deteriorating more rapidly, and consequently in extra work being involved in resinking the impressions. Production will be decreased proportionately with the amount of difficulty experienced in removing the drop-forging from the impression. Insufficient draft for dies having deep impressions will also increase the probability of breakage.

In laying out the die impressions from a drawing or sample, when they are not to be sunk on an automatic engraving machine of the profiling type, the allowance for

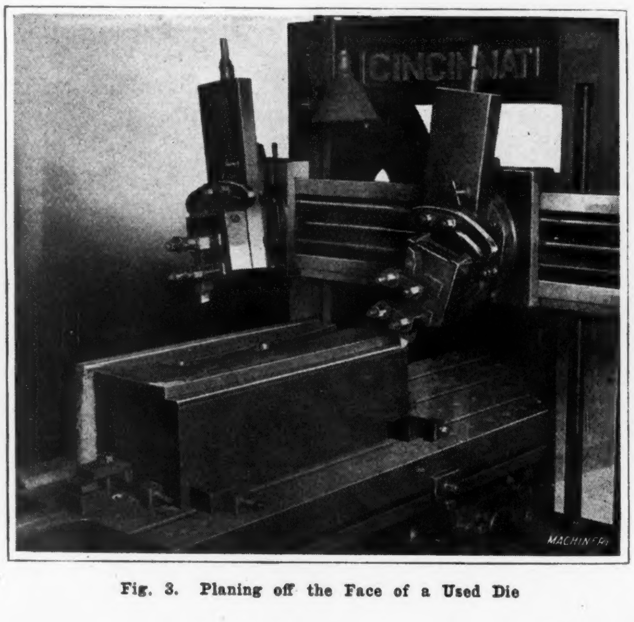


Fig. 3. Planing off the Face of a Used Die

shrinkage is taken care of by using standard shrink rules, ⅛ and 3/16 inch to the foot, as determined by the shape and size of the forging and its material. (If a mechanical engraving machine is employed to sink the impression, all necessary allowances are taken care of when making the pattern or model used on machines of this type.) On a long slender part, a greater shrinkage allowance should be made on the length than would be necessary if the forging were nearer average proportions. If the forging is to be trimmed cold, it will shrink more before trimming than a hot-trimmed forging, and so the allowance for shrinkage on the second-operation or finishing dies should be made accordingly.

The allowance which must be made in the designing of a die to provide additional metal for machining purposes is of vital importance. The amount of material left for finishing varies according to the practice in different drop-forge plants. It is the custom in many shops to allow at least 1/32 inch, even on small pieces where a machining cut is to be taken, and on the larger forgings an allowance of 1/16 inch is made. On parts such as crankshafts, from 3/32 to ⅛ inch or even more may be allowed, depending on the nature of the forging design. All finish allowances are additional to the allowance for draft.

One company handling a large business follows a practice of making a forging-size drawing of the part, on which the allowance for machining, draft, etc., is shown, and the outline of the part as it will appear after machining is indicated by dotted lines, as Fig. 2 shows. Two blueprints of these drawings are sent to the customer so that he may approve it and be informed as to just what he will receive and whether the allowances are sufficient for his purpose. After an approved blueprint has been returned to the drop-forge plant, the dies may be safely made. This is good practice, though not general, it usually being considered sufficient to pour a lead casting in the dies and send it to the customer to be checked and approved by him. This cannot be as readily done by the customer as could the inspection of a drawing, which also leaves a permanent record for the contractor and carries the approval of the customer before the expense of sinking the impression has been incurred. Of course, if a change in the impression were necessary after the lead casting had been made, the welding torch could be resorted to for building up the impression or for removing metal, but in either case the question of expense enters. This expense will not be encountered if a drawing of the forging is first made and submitted for the customer's approval.

Other Details in Die Design

The details shown in Fig. 2 bring out another point in die design besides that of allowances. This forging is a planet cage for a high-grade gas engine. The parting line is indicated on the drawing; the section to the right of the parting line is produced in the lower die, and the section in which lugs *A* are to be forged, in the upper die, advantage being taken of the tendency of hot metal to shoot up. It will be noticed that there is a regular 7-degree draft allowed for the hub in the lower die, but that a much greater draft is provided on the upper die than appears to be needed. This is necessary in order to make the two impressions meet at the parting line, where the flash formed in the drop-forging operation must be trimmed. It will be obvious that if these two draft surfaces were not made to meet at a common outline the forging could not be properly trimmed and consequently the forging would be spoiled.

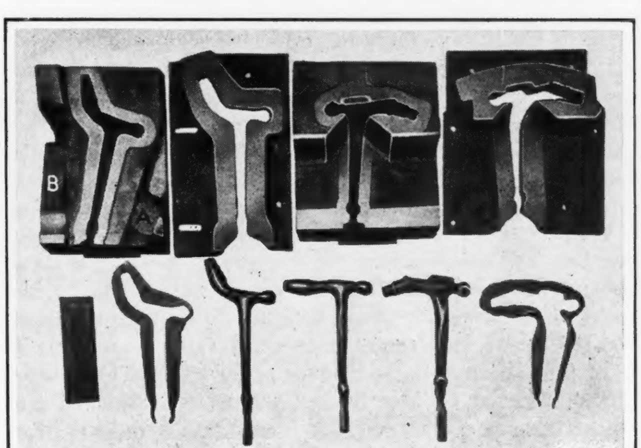


Fig. 4. Forging and Trimming Dies for Automobile Steering Arm

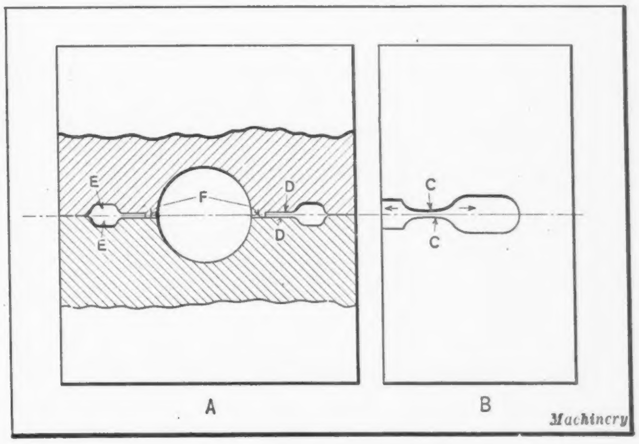


Fig. 5. (A) Section from Flash Recess. (B) Side View of Fuller

Before the impressions are laid out, or the machine model made, there is another point in design to be considered and that is the arranging of the impression so that the heavy end of the forging will be in the front part of the die-block. This facilitates handling the forging which, for larger work, is done by using tongs to grasp a projecting sprue or "tong-hold." If the heavy end is placed at the rear of the die-block, additional effort will be required to handle the forging. If the impression is deep and the forging correspondingly heavy, the channel in which the tong-hold is formed, should be large enough so that the weight of the forging will not cause the sprue to bend when the part is being handled while it is yet hot. If the forgings are of a small size, they will probably be hammered from the bar, and the statements previously made regarding the position of the impression in the die-block will not apply. On account of the increasing demand for large drop-forgings, however, the point is a valuable one, because the steel from which these forgings are made is first cut into blanks of the proper size and handled from one end, as previously mentioned, by tongs.

Laying out the Die Impressions

The die-block is first faced and squared up on two adjacent sides to a depth of two or three inches, as indicated in Fig. 1. This is done by planing, and the dovetail shank *A* on the opposite side of the die-block is also planed. In planing the shank, it should be remembered that it must be absolutely parallel with the sides of the die-block and accurately located, because it is by means of the shank that the die is aligned with the center of the hammer ram. If the shank is not accurately machined, it may result in the dies gaping so that the blows struck by the hammer may ultimately ruin the die and at best produce forgings of only questionable quality. After the impressions have been worn so that the dies are no longer serviceable, the faces are planed off as shown in Fig. 3, and the impressions resunk.

Modern developments in the method of sinking the impresssion in a drop-forging die have resulted in obviating, in large measure, the amount of hand work required in finishing the die impression, and have also, by the use of ingenious automatic machines, eliminated the need of lay-

ing out the die impression on the face of the block. There are a great many drop-forging plants, however, engaged in the manufacture of their own dies, where the method is still followed of first laying out the impression and then sinking it with the most convenient type of machine tool available in the die-room.

In the actual laying out of the die impressions, a metal templet is commonly employed, which is made from the drawing of the part. The templet is laid out to a shrinkage scale, and suitable additions (such as already described in detail) made for finishing and for draft. The laying out of this templet is usually entrusted to one man who has had experience in the reading of drawings and who is familiar with this branch of the work. The templet is first laid on the face of the block (see Fig. 1) which has previously been coppered, and is so arranged that the impression will be about central and in no case too near the edge of the die-block. The die shown being laid out is for the connecting-rod *C*, the templet for which may be seen lying on the block at *D*. For medium size and large work, the block should be large enough so that the impression will not be closer than 2 inches from the edge at any point. The outline is then scribed and gone around with a prick-punch.

It will be noticed that in laying out the die, the squared side is used as a straightedge, in connection with a combination square and other ordinary instruments. The squared sides assure that the impressions in mating dies will be accurately located from the same surface. These matching sides are located on the right-hand side of mating dies, as seen from the front of the hammer, and are the means by which it is possible to set up the job in the hammer so that the impressions will match perfectly.

The work necessary on the face of the die, if the forging is of simple design and contains no offsets so that it can lie in one plane, is simply that of sinking the impression and milling a shallow space around it in which the flash can flow. Sometimes this shallow recess *D*, Fig. 5, is, in turn, surrounded by a deeper gutter *E*, so that if the flash is excessive, it can be prevented from spreading farther than the confines of the flash impression. The impression in the upper die is surrounded by a ridge *F*, which is not found on the lower die. The function of the ridge is to force the hot metal to flow into the flash recess. The forging design is seldom such as to occupy only one plane, and frequently it becomes necessary to provide a fuller, such as at *A*, Fig. 4, on one side of the block, and an edger *B* (sometimes called a "buster") which is usually located on the opposite side of the dies from the matching edges.

The Fuller and the Edger

The purpose of the fuller is to draw out the stock to approximately the desired length, and its design is of greater importance than might at first be thought. If it is made too narrow, it is likely to produce cold shuts; if it is too short the stock will be gouged into, which will result in an irregular surface and an inferior structure in the forging. It should not be attempted to design the fuller so that the end of the stock can be drawn in one "bite" of the dies. The diagram *B*, Fig. 5, conveys an idea of the proper design. The impressions in mating dies should be necked as at *C*, with the shallow impression of the neck running into a deeper impression that accommodates the end of the stock. The surface of this neck should be rounded or crowned, so that when the first blow is struck the crowned impressions of the neck will force the stock to flow in both directions; then the blank or bar may be moved in or out and hammered until the proper reduction in section has been obtained.

The purpose of the edger is, as may be inferred by inspecting the breakdown die at the left in Fig. 4, to form the blank into the approximate shape of the forging so that it may then be laid in the impression and reproduced. The templet used in laying out the impression for the die may be here again put to good usage by laying it on the side of the two matched die-blocks and scribing the outline so that the anvil, or lower-die edger section, will support the edged blank and locate it so as to be convenient for the hammerman. Convenience in handling the forging seems to be the main consideration in laying out the edger.

The fuller, which is not likely to be deep, is located on the matching or right-hand side, if the die contains an edger; if not, it is placed on the left side, opposite the matching sides, so that these will not be cut into. The edger often cuts into the side of the die to such a depth that if it were placed on the right-hand side it would cut away entirely the matching surfaces. Where more than one operation is required in making a drop-forging, the fuller and the edger are necessary only on the first, or what is termed the breakdown die, as will be understood from the illustration, Fig. 4. The die shown at the left is the lower breakdown die for an automobile steering arm and is provided with both a fuller *A* and an edger *B*. The other dies shown in this illustration are, from left to right, the rough trimmer, the finishing die, and the finish trimmer, all of which are lower dies. The various steps in the evolution of the steering arm are shown in the lower part of the illustration, these being the blank, the flash produced in the breakdown dies, the first-operation forging before and after bending the end, the finished forging with sprue attached, and the flash.

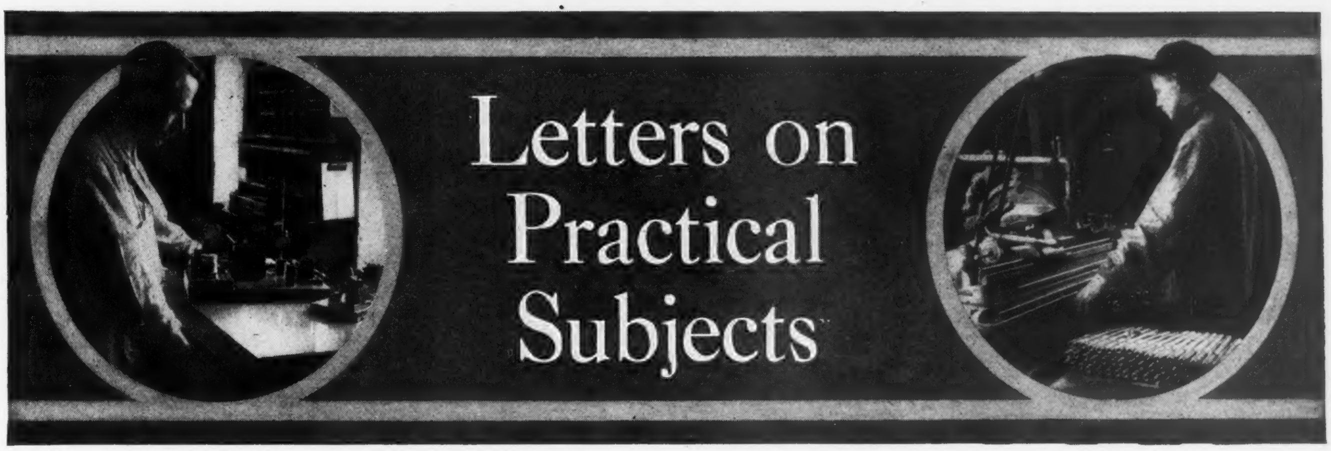
MACHINERY is indebted to the Union Switch & Signal Co., Swissvale, Pa., and J. H. Williams & Co., Brooklyn, N. Y., for much of the information contained in the foregoing. The second article on this subject, which will appear in the September number of MACHINERY, will describe in detail the methods by which die impressions are sunk, and will give complete information on the design, construction, and provision for shear on trimming dies, including formulas for calculating pressure in pounds required to force a forging through the die opening.

* * *

TRADE BETWEEN SWEDEN AND RUSSIA

Swedish newspapers report that a number of leading manufacturing concerns in Sweden have formed a trading syndicate for the purpose of doing business with Russia. The capital represented by these concerns exceeds $250,000,000, and two prominent men have been selected to go to Russia with a view to making the necessary trade arrangements. It is recognized that all of the trading cannot be done on a basis of gold payments, but that some of it will have to be done by barter or exchange. This makes it necessary that the firms that are members of the syndicate represent varied groups of industry so that some of them may be able to use, or at least dispose of, the raw materials that may have to be taken in payment for the finished goods sold by other members of the syndicate. The Soviet Government has placed orders for 1000 locomotives in Sweden and also for 800 cylinders for repairing old locomotives.

It has been reported by the New York *Times* that nineteen tons of Russian gold were melted and reissued as Swedish currency in 1920 in addition to seventy tons of Russian gold which arrived at Stockholm, representing a value of approximately 71,000,000,000 gold rubles. There were deposits of Russian gold in Swedish banks amounting to $160,000,000, of which $50,000,000 was later transferred to other European countries, while $50,000,000 has been deposited as securities for commercial orders placed by the Soviet Government in Sweden. The remainder is being held for future disposal as orders are being placed. It is stated that an appreciable amount of Soviet gold has passed through Sweden to America, as the United States is not transacting direct business with Russia, but uses Sweden as an intermediary. Most of the American firms who are doing business with Russia maintain agents in Sweden or other Baltic ports.



UNIVERSAL JIG FOR DRILLING COTTER-PIN HOLES

A universal jig for use in drilling cotter-pin holes in pins and screws such as shown in Fig. 2 is illustrated in Fig. 1. While this jig was primarily designed for use in drilling cotter-pin holes in pins such as those shown at *A*, Fig. 2, it has also proved useful in drilling holes for cotter-pins and dowels in studs and screws like those shown at *B*. This tool can be used in drilling holes of various sizes in pins or screws from 1/8 to 3/8 inch in diameter. Means of adjustment is also provided for locating the holes at any required distance from the end or shoulder of the work. When two holes are to be drilled in a pin, the required distance between them can be obtained by adjusting the members that carry the drill bushings.

A cast-iron base *A* is employed in the construction of the jig. To this base is fastened a machine-steel block *D*. In block *D* there is a milled slot that guides a hardened steel V-block *E* in which the pins to be drilled are placed. A hardened steel wedge *F*, operated by screw *G* having a left-hand thread, causes block *E* to be raised when knob *J* is turned, thus clamping the pins to be drilled against bushing-holders *H*, so that the work will be prevented from shifting while the drilling operation is being performed. A quarter turn of knob *J* will lower or raise V-block *E* a sufficient amount to permit the pins for which the jig is set, to be freely entered or removed. By operating the hand-knob, V-block *E* may be adjusted so that pins of any diameter within the range of the jig can be held in place.

Plates *K* and *L* are fastened to block *D* and serve to guide the V-block. It will be noticed that openings are cut in these plates to allow wedge *F* to pass through. On plate *L* is a movable stop *M* which locates the pins endwise in the V-block, and is operated by lever *N*. When lever *N* is pressed down, stop *M* is withdrawn from in front of the vee so that the drilled pin will be pushed through and dropped on guard *O* by the new piece which is inserted from the opposite end. Guard *O* protects the threads of screw *G* from the chips and also serves as a chute for conveying the drilled pins to a box or other receptacle under the front end of the guard. When drilling large quantities of pins, the jig may be attached to the drilling machine table by means of a plate provided with a T-slot. When two holes are to be

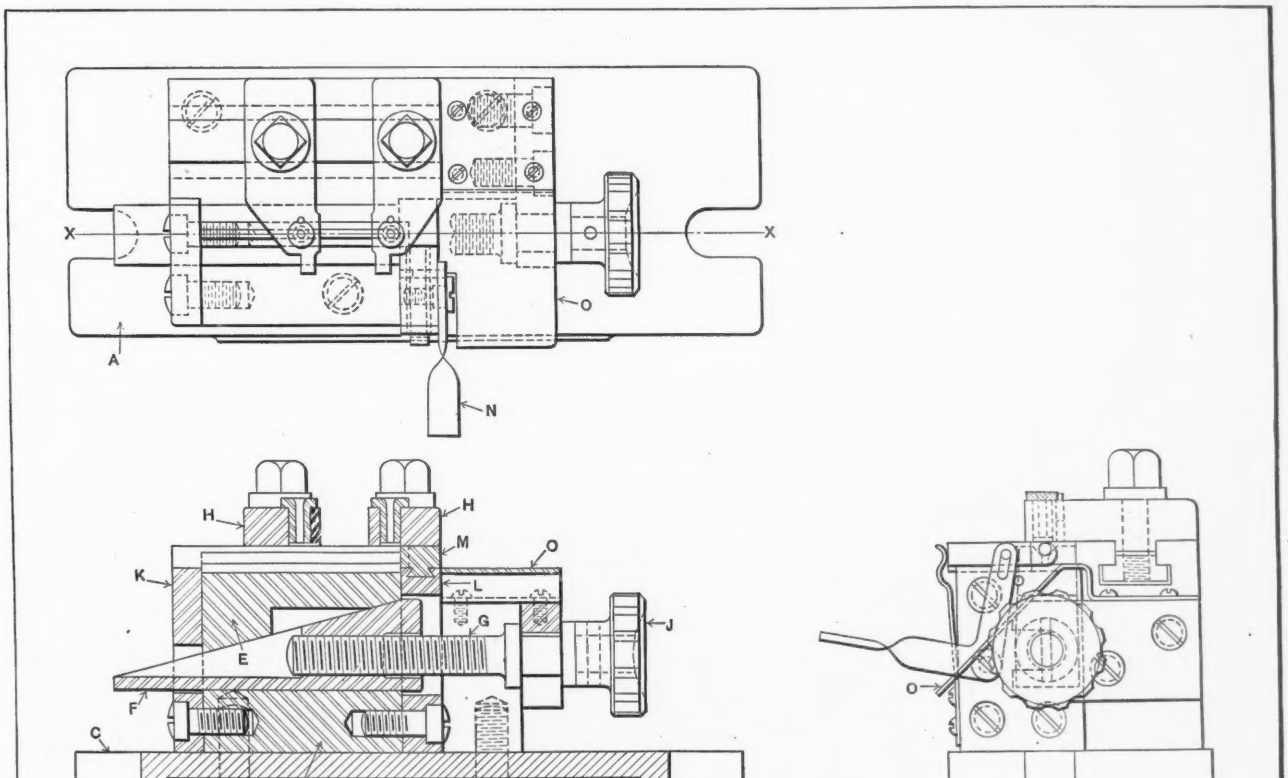


Fig. 1. Jig for drilling Cotter-pin Holes in Pins of Various Kinds and Sizes

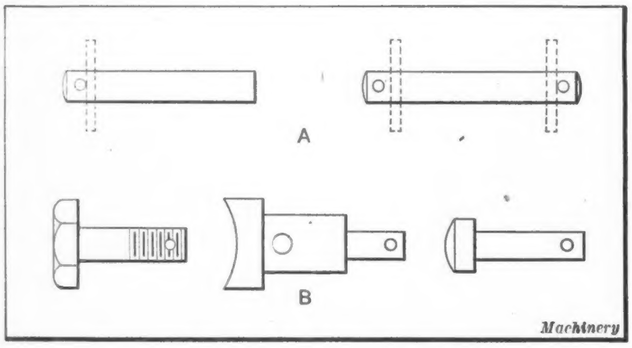


Fig. 2. Types of Work drilled by Use of Jig shown in Fig. 1

drilled in each pin, a multiple drilling head attachment can sometimes be used, thus enabling both holes to be drilled at the same time. This tool has proved to be very useful in a plant where various kinds of special machines of light weight are constructed in large as well as small quantities.

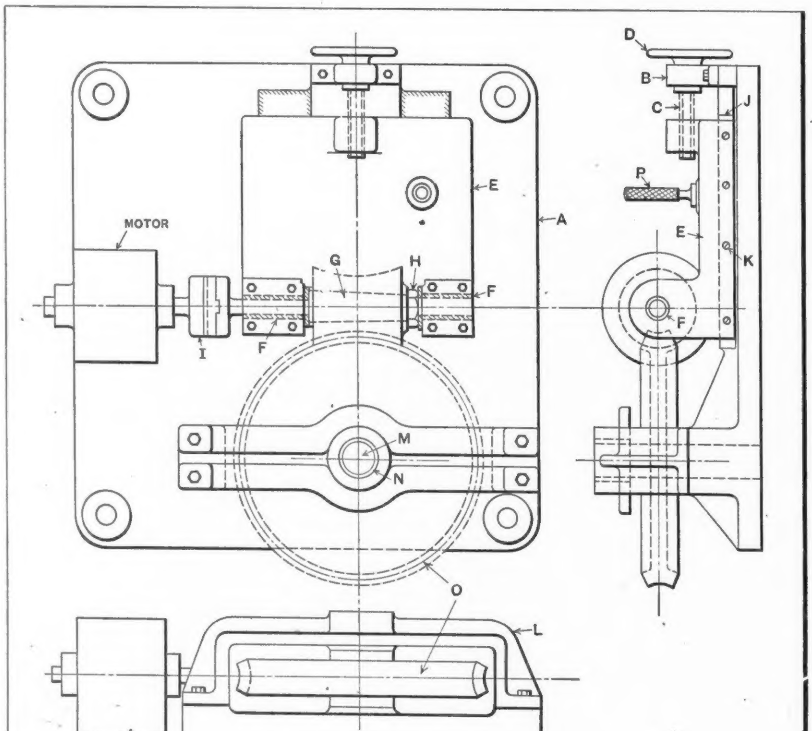
Cleveland, Ohio A. J. CAYOUETTE

FIXTURE FOR GRINDING-IN WORMS AND WORM-WHEELS

The fixture shown in the accompanying illustration was designed for grinding-in worms and worm-wheels used in the construction of automobiles, but it is also adaptable for use in other cases where worm drives are employed to a considerable extent. With a slight modification of the design it could also be used to grind-in helical gears. The fixture simply provides a means of rotating a worm and worm-wheel in mesh, the grinding or lapping being accomplished by a mixture of oil and an abrasive applied to the contact surfaces. It will be noted that the electric motor which drives the parts to be ground-in, is located on base *A*, thus making the fixture self-contained so that it can be easily set up in any part of the shop or moved from place to place. If desired, the fixture could be arranged for belt drive by providing a tight and loose pulley, so that the rotating members could be stopped to permit the removal and insertion of work.

The pad on which the motor is mounted, and the dovetail section which carries slide *E*, are cast integral with the base. It will be noted that a separate bracket *B*, which carries screw *C*, is bolted to the base. Screw *C* is operated by handwheel *D* to obtain the proper adjustment of slide *E*. Slide *E* is made of cast iron, and has two bearings *F* which carry the worm-arbor *G*. This arbor is made of hardened steel and is accurately ground to size and provided with a lock-nut *H*. It is necessary to have a joint of the kind shown at *I* to enable slide *E* to be adjusted. With a belt drive this joint would not be required, as the belt could be provided with a compensating pulley that would permit the necessary movement. The slide has a gib *J* which can be adjusted by screws *K*, to take up any looseness that might result from wear.

The cast-iron bridge *L* forms a top support for the worm-wheel spindle *M*. Spindle *M* rotates in hardened steel bushings *N*, and carries the worm-wheel *O* which is keyed to it. A hardened steel plug *P*, located in a hardened steel bushing in the slide, serves to determine the proper depth to which the worm and worm-wheel should mesh when properly ground-in. When this point has been reached, the plug can be slipped through into a bushing in the base.



Fixture for grinding-in Worms and Worm-wheels

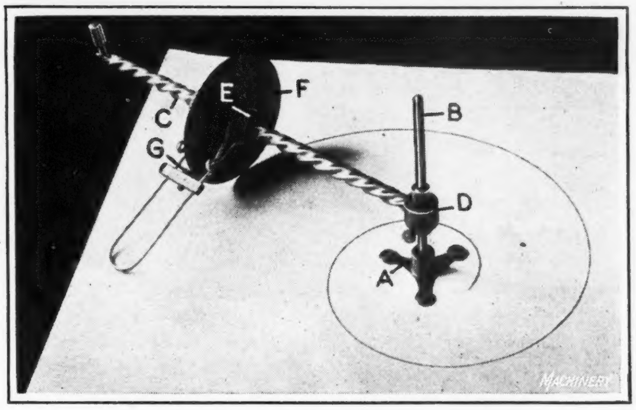
When grinding-in a worm-wheel a hardened steel worm corresponding to the one that is to be used with the worm-wheel is mounted on arbor *G* and locked in position by nut *H*. This arbor is then set into place between the bearings on slide *E*, care being taken to see that the center plate of joint *I* is in the proper position to slide into place. The bearing caps are then bolted down, after which slide *E* is drawn back by turning handwheel *D*, so that the worm will clear the worm-wheel while the latter is being put in place. The worm-wheel is mounted on spindle *M*, after which it is placed in the fixture and held there by bolting down supporting bridge *L*.

When the fixture is in operation, a solution of engine oil and fine carborundum or some other abrasive mixture is fed slowly to the hardened steel worm as it rotates; at the same time the worm is fed gradually into the worm-wheel until it reaches the full depth as determined by stop-plug *P*. If it is necessary to feed it in a little deeper to provide more clearance, the plug is removed and the worm fed in the required amount. To grind-in a worm it will, of course, be necessary to have a hardened steel worm-wheel which can be used in a similar manner to grind-in the mating part. This fixture was designed by the writer and has been used successfully by a large manufacturing company in England for a number of years.

Cleveland, Ohio C. F. GEORGE

INSTRUMENT FOR DRAWING LOGARITHMIC SPIRALS

While there are several instruments that can be used to develop a logarithmic spiral—a curve extensively used in connection with the design of milling cutters and circular saws—they are all more or less complicated and therefore expensive. A simple and inexpensive instrument for drawing these curves, which can be made by a skilled mechanic, is shown in the accompanying illustration. This instrument consists primarily of a stand *A*, which supports a vertical shaft *B*; a screw *C*, provided with a sleeve *D* which is a sliding fit on the vertical shaft; a nut *E*; and a sharp-



Instrument for drawing Logarithmic Spirals

edged marking disk *F*, which draws the spiral on the paper. An inking pad *G* can be attached as shown.

If screw *C* is turned around the fixed vertical shaft, the disk describes on the paper a curved line which is a logarithmic spiral. The length of the arc of this curve depends upon and is proportional to the developed length of the disk and increases simultaneously with the increase of the radius. Only the logarithmic spiral has these characteristics, and it is evident that logarithmic spirals of different pitches can be described by changing either the lead of screw *C* or the diameter of disk *F*. It will be found best to design the nut on the screw so that it will be possible to attach disks of different diameters. This instrument can also be used to advantage in designing spiral frames for turbines and turbine pumps.

Elmhurst, L. I. PAUL SCHWEITZER

FIXTURE AND TOOL EQUIPMENT FOR FACING MOTOR HOUSING

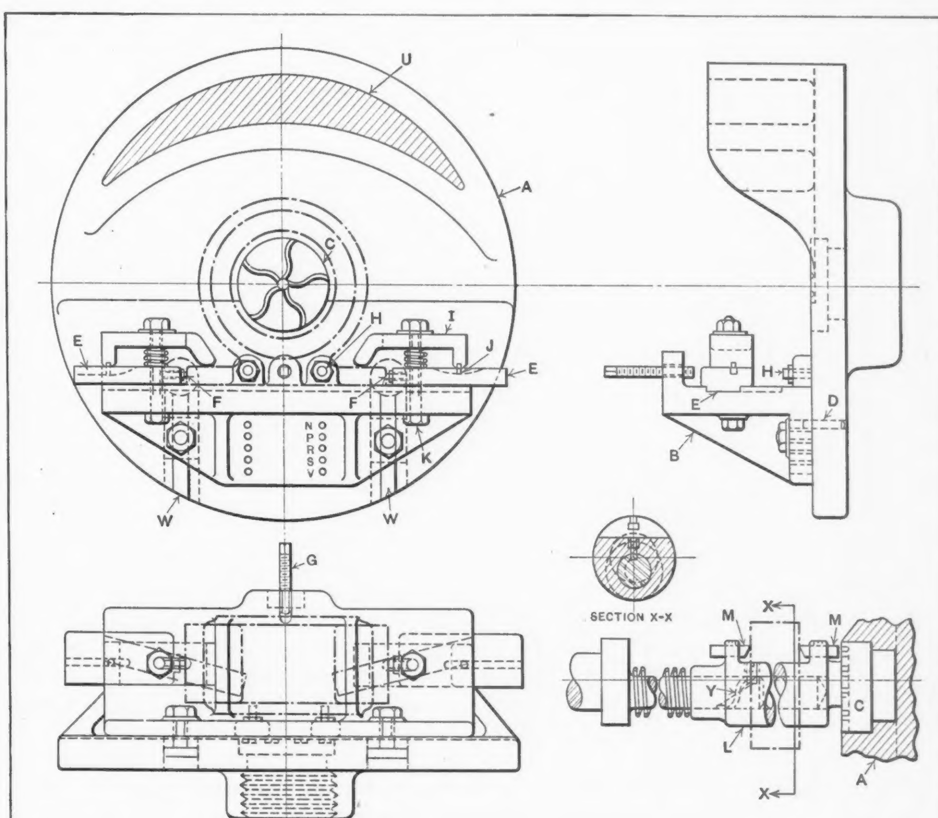
A novel facing tool and fixture used in machining both faces of a motor housing in one set-up on a turret lathe are shown in the accompanying illustration. The principle on which the tool operates should find ready application to various lathe and boring mill jobs. The tool and fixture effected quite a saving of time in that it made it possible to perform all the boring and facing operations on the motor housing in one set-up. The fixture can be adjusted to accommodate several different sizes of housings. It is threaded to fit the spindle of the machine, and takes the place of the regular faceplate. The facing tool, which is shown in the lower right-hand corner of the illustration, is not adaptable to different sizes, a separate tool being required for machining each size of housing.

The body of the fixture *A* is an iron casting, part of the face being finished to permit the attachment of angle-plate *B*. On the side opposite *B* are two ribs so constructed as to form a recess *U* which is filled with babbitt to counterbalance angle-plate *B*. Driven into the center of faceplate *A* is a hardened bushing *C*, which takes the thrust of the facing tool, as will be explained later. Two dowel-pins *D* driven into faceplate *A* serve to locate angle-plate *B* in the proper positions for the various sizes of housings, a pair of holes being provided for each size of housing which the fixture is made to accommodate. Each set of holes is stamped with the letter corresponding to the size of housing for which it is intended, in order to facilitate setting up the fixture. Two T-slots *W* in faceplate *A* accommodate bolts for clamping angle-plate *B* in place after it has been located by the dowel-pins.

Angle-plate *B* is an iron casting, and is ribbed to provide rigidity. The top surface is finished, and two oblique keyways are milled on this surface to receive the bosses which project from the bottoms of blocks *E*. These keyways are cut at an oblique angle so that as blocks *E* are adjusted in or out, locating screws *F* will always retain their central positions relative to the housing. Location of the work is accomplished by nesting it between screws *F*, where it is clamped in place by screw *G*, which forces it against locating pins *H*, and clamps *I* which are lifted off the work by springs when the nut is released; these clamps can be pushed back out of the way for loading. Pin *J*, by riding in a keyway in block *E*, keeps clamp *I* from turning. Block *E* is tapped to receive bolt *K* which holds it in place. This bolt is likewise utilized for tightening clamp *I*.

The facing tool, shown in the lower right-hand corner of the illustration, consists primarily of a body, having two shanks which are eccentric, and a bushing *L*, the bore and outside diameter of which are turned eccentric the same amount as the body. A spiral keyway *Y* is milled in the shank, which receives a pin held in the bushing. The tool is so assembled that when it is in the relaxed position, the two eccentrics counteract each other, and the outside diameter of the bushing is central with the spindle of the machine.

When the facing tool is fed in, the face of bushing *L* abuts against the face of bushing *C* in the faceplate, and as the shank is fed in farther, it causes bushing *L* to turn thus forcing it off the true center and thereby producing an outward feeding movement of the tool bits *M*. Several S-shaped slots or grooves radiate from the center of bushing



Fixture and Tool used on Turret Lathe for facing Motor Housing

C and provide clearance for dirt and chips. These slots are important, and must not be omitted. The amount of eccentric offset of the shanks of the tool body must be equal to a little more than half the width of the face to be machined.

Brooklyn, N. Y. LESTER FERENCI

MILLING INTERMITTENT GEARS ON AN AUTOMATIC

On page 753 of the April, 1920, number of MACHINERY a method of milling intermittent gears on a Brown & Sharpe automatic screw machine was described. Another good method of doing this work is here presented, which does not require the stopping of the spindle and permits using greater feeds and speeds.

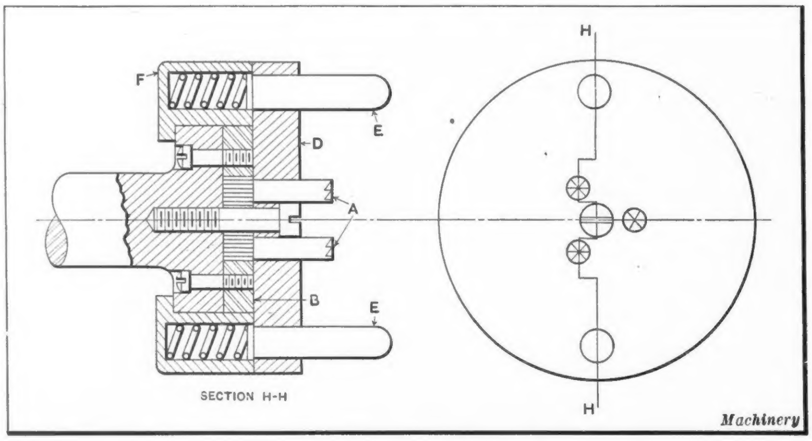


Fig. 1. Tool for milling Intermittent Gears

The end-mills *A*, Fig. 1, have small gear teeth cut on their rear ends which mesh with teeth of the internal gear *B* and are held in the proper relation to the internal gear by plate *D*. The internal gear *B* is fastened to the shank by screws, the shank being held stationary in the turret. As the tool is brought forward to the work by means of the lead cam, the driving pins *E*, which are also held by plate *D*, enter the pin wrench holes in the spindle cap thus rotating the body which, in turn, revolves the end-mills.

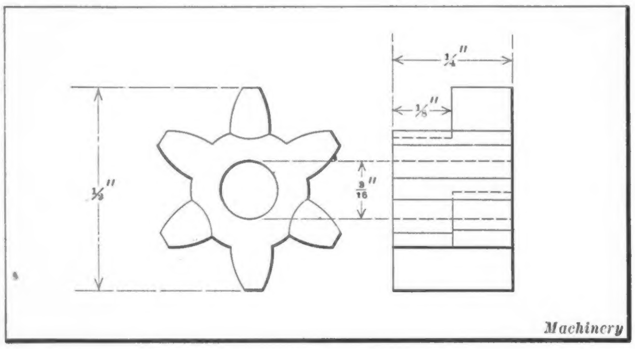


Fig. 2. Intermittent Gear machined by Tool shown in Fig. 1

The collet is keyed to the spindle in proper alignment with the pin wrench holes in the spindle cap so that the end-mills will be properly located in relation to the work. The driving pins *E* are backed by springs in collar *F* so that when the tool first comes into contact with the spindle cap the pins will act as a friction clutch, not being able to enter the pin wrench holes in the spindle cap until the revolving body has attained the same speed as that of the spindle.

The collar *F* is held to plate *D* by four screws (not shown). The order of operations for making the intermittent or skip gear shown in Fig. 2 from extruded brass bars on a No. 0 Brown & Sharpe automatic screw machine, using spindle speeds of 810 and 1800 revolutions per minute is given in the accompanying table.

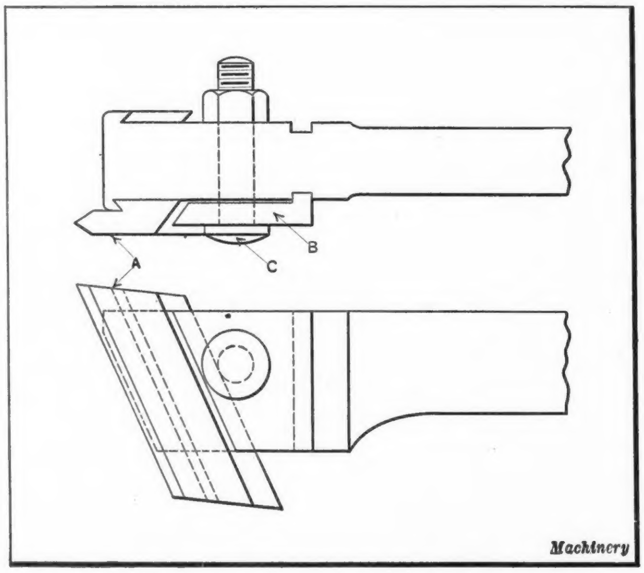
Chicago, Ill. J. B. AMSTUTZ

ORDER OF OPERATIONS FOR MAKING INTERMITTENT GEAR ON BROWN & SHARPE AUTOMATIC SCREW MACHINE

Speed	Operations	No. of Rev's.	Cam Rise	Feed per Rev.
High	Feed stock	16	.....	.....
High	Revolve turret	19	.....	.....
High	Center	8	0.040	0.005
High	Revolve turret	19	.....	.....
High	Drill	32	0.320	0.010
High	Revolve turret	19	.....	.....
High	Ream	19	0.270	0.014
Slow	Revolve turret	19	.....	.....
Slow	Mill teeth	19	0.125	0.007
High	Clear mill	5	.....	.....
High	Cut off	92	0.180	0.002
High	Clear stock	3	.....	.....
	Total	270 = 9 seconds per piece		

THREADING TOOL AND TOOL-HOLDER

The threading tool and tool-holder shown in the accompanying illustration is intended primarily for use in performing threading operations in the engine lathe, although it can also be used in the turret lathe and screw machines. It is especially well adapted for threading brass work, such as valves and pipe fittings. The holder is so designed that the threading tool can be held either on the left-hand or right-hand side as desired. Two clamps, one of which is shown at *B*, are required, one being designed for use in holding the cutter on the right-hand side and the other for holding the cutter on the left-hand side of the holder.



Tool-holder for holding Threading and Forming Tools

For tool-room use, a threading tool having one cutting tooth or point like that shown at *A* in the tool-holder is employed. This type of tool is well adapted for cutting threads in steel, but for brass work it is usually preferable to have the cutter made with two teeth instead of one. The tool-holder can also be used to advantage for holding forming tools for form-turning operations on brass work, such as required in finishing valves and other pipe fittings. For operations of this kind performed in a forming lathe, one tool-holder can be held at the front of the work, one at the rear, and one in the operating bar.

Chemnitz, Germany T. R. WAGNER

The British Machine Tool Industry

From MACHINERY'S Special Correspondent

London, July 15

THE outlook in trade generally is now distinctly brighter than for many months past. The long stoppage of work in the coal mines has been brought to an end, and the threatened trouble in the engineering trades has been avoided. The miners' strike ruthlessly aggravated a condition of trade that was already deplorable, and the only satisfaction to be gained from the dispute is the fact that for the first time in a large industry as a whole a profit-sharing scheme has been accepted by both owners and workers. This is generally considered to be a step that will have an excellent effect on the attitude of labor, provided a long enough trial is given to the project.

In the machine tool trade there were signs of improvement even previous to the ending of the coal dispute; but it may be some little time before an improvement is felt on the production side, as there are so many firms who have been accumulating stocks in preference to shutting down their works.

Ground Bars and Precision Gages

The production of ground steel bars is developing rapidly; at present most of these are exported to France, where the advantages of bars in this form appear to have been quickly appreciated. The first cost appears to be against precision ground bars; but as they can be ground to within 0.0005 inch on the diameter, a great many uses have been found for them, not only in machine tool building but in many other classes of work. Their use eliminates many operations when used for pins, feed-shafts, twist drills, reamers, and similar work.

The production of precision reference gages in this country is being watched with considerable interest. Several sets of standard gages made by an English firm have been tested at the National Physical Laboratory, and have been found to be within the limits required for certification. The limits allowed are plus two hundred-thousandths and minus one hundred-thousandth inch for gages under 2 inches, while larger gages are allowed more or less proportionate tolerances.

The laboratory has recently completed a very important piece of work, comprising the production of standard end gages with flat parallel end faces strictly perpendicular to the gage axis. A lapping jig similar to that used for finishing precision gages is used, and the resulting end faces have been tested and found to be flat and parallel to within five-millionths of an inch. The gages are made from carbon steel, hardened at the ends only.

Overseas Trade in Machine Tools

The official returns giving figures on the import and export trade in machine tools for May are remarkable in many ways. Exports fell during the month, but to a figure only a little lower than that of twelve months ago when trade in general was immeasurably better. Imports were maintained at the low figure—about 250 tons—they have shown for the last three months. For more than a year, up till last March, the value per ton of imported machine tools had been high, ranging from £225 to £275. In April this figure fell, and the fall continued in May, reaching only a little over £150 per ton, a figure around which the value per ton of exported machine tools has remained very steadily for more than a year. The tonnage imported per month is so small that any variation in the type of the tools would make a considerable difference in the value per ton, but at the same time there is other evidence that foreign makers have been accepting lower prices for their machines, while a smaller proportion of the more costly and elaborate machine tools have been imported.

Among the machine tools exported during May were 138 lathes. The majority of these were of the heavier type, and the same remark applies to the 174 drilling machines exported. In both these classes of machines, and also in milling machines, the imports were insignificant by comparison, but grinding machines and power presses were imported and exported in more or less equal numbers.

New Machine Tools on the Market

Despite the recent poor trade prospects, the faith of makers in the immediate future of the machine tool industry is shown by the continual appearance of new and improved designs in machine tools of all classes. Smith & Coventry, Ltd., of Manchester, have brought out some new Bateman planing machines, 10-foot stroke and 5 feet square. They are driven by 18-horsepower motors and have two cross-slide tool-heads and two side tool-heads to which rapid power traverse is applied. The table cutting speeds may be varied from 30 to 60 feet per minute in three changes, while the return stroke is constant at 120 feet per minute. Another new product of the firm is a brass finisher's lathe with automatic dead stops for both lengths and diameters; the control arrangements of this lathe are very well carried out.

The spiral bevel gear generator shown by Smith & Coventry at Olympia last year is proving very satisfactory under extended trials; a 51-tooth by 5-pitch steel motor back axle gear can be cut from a rough gashed blank in one hour, while the corresponding pinion with 15 teeth takes twenty minutes.

Another new planer, with a 3- by 3- by 8-foot stroke, is built by the White Machine Tool Co., Burnley Road, Halifax. These are essentially heavy-duty machines, the housings being exceptionally rigid, while all driving pinions and feed-gears are 0.4 carbon hammered steel.

Prices of Materials

The month of June saw further reductions in the prices of materials. Round steel bars fell from £15 10s to £13 10s per ton, while steel plates dropped from £19 15s to £15 15s per ton, and boiler plates that stood at £31 in January have now fallen to £21 per ton. Other metals do not show such decisive drops in prices, but the tendency is consistently downward.

* * *

THE PROVISION FOR MACHINE TOOLS IN NEW TARIFF BILL

The metal schedule of the permanent tariff bill, as passed by the House of Representatives, provides, in regard to machine tools, as follows:

> Machine tools and parts of machine tools . . . and all other machines and parts thereof, finished or unfinished, not especially provided for, 35 per cent ad valorem: Provided that machine tools, as used in this paragraph, shall be held to mean any machine operating other than by man power which employs a tool for work on metals.

This provision is made in Paragraph 372 of Schedule 3 of the new tariff bill. Schedule 3 includes metals and manufactures of metals.

NEW METHOD OF MANUFACTURING WORMS

The production of multiple-threaded worms in the lathe or by the thread-milling process necessitates intermittent indexing motions which often result in inaccuracies. The hobbing method, with its inherent advantage of progressive and continuous indexing, eliminates this objectionable feature. The Gould & Eberhardt Co., Newark, N. J., has recently developed a method of hobbing worms, one of the features of which is the special form of helicoidal cutter or hob employed. The design of these hobs permits worms to be hobbed which have a shoulder on either or both ends. The type of hob employed is illustrated in Fig. 1. The teeth are arranged helically as in regular gear hobs. There are about fourteen roughing and three finishing teeth. It will be noticed that there are only about one and one-half or two convolutions of teeth, thus making the hob much shorter than gear hobs, the length being about twice the normal linear pitch of the worm to be cut.

Action of Hob

The action of the hob is in the nature of a progressive roughing and finishing cut. The tops and sides of the roughing teeth are increased in regular increments. The first roughing tooth is made high enough to reach into the worm to half the depth of the thread, each succeeding tooth removing a little more metal, until the finishing teeth complete the worm tooth shape. The arrangement of teeth just described makes this hob analogous in its cutting action to that of a broach coiled around a cylinder. The removal of metal is accomplished progressively, and the cutting action is distributed over all the teeth. If the hob is made in the ordinary manner, it will be found that the "following" side of the hob teeth will cut away part of the worm thread from the pitch line to the outside diameter of the worm, unless suitable corrections in the form of the hob teeth are made. This condition necessitates a different lead of helix on opposite sides of the teeth, the "leading" side being made to the basic lead calculated from the normal linear pitch, and the "following" side recut to a shorter lead sufficient to clear the theoretical contour of the worm thread section. In setting up the machine, the middle of the three finishing teeth is centered with the axis of the worm. The amount of feed of the cutter-head relative to the axis of the worm depends on the helix angle of the worm thread; the greater the angle, the less the axial feed and vice versa. The fixture for holding the worm blank should be of a very rigid design and be provided with powerful means for driving, since the strains produced by the hobbing process are severe.

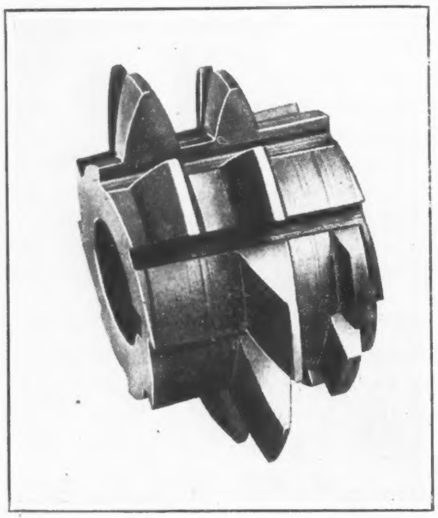


Fig. 1. Type of Hob used in cutting Worms

Production and Accuracy Attainable

The outstanding features of any thread-cutting process are the rate of production and the degree of accuracy attainable, and it is these features by which the merits of any process should be judged. The production possible with the hobbing method of manufacturing worms is much greater than can be obtained with the lathe or rotary milling cutter methods. This advantage is especially noticeable in the case of multiple-threaded worms, because the machine is geared for the number of threads, just as in hobbing helical gears. This obviates the necessity of indexing by hand and taking a fresh cut through the worm threads. In Fig. 2 is shown the set-up of one of these special hobs mounted in a gear generating machine for finish-threading low-carbon steel single-threaded worms. These worms have a 3 1/8-inch outside diameter, 0.667-inch linear pitch, and are 4 1/2 inches long. The axial feed of the cutter was 0.007 inch per revolution of the blank, and the speed of the cutter 51 R.P.M. The worms were finished with one cut, the production time, floor to floor, being seventeen minutes each.

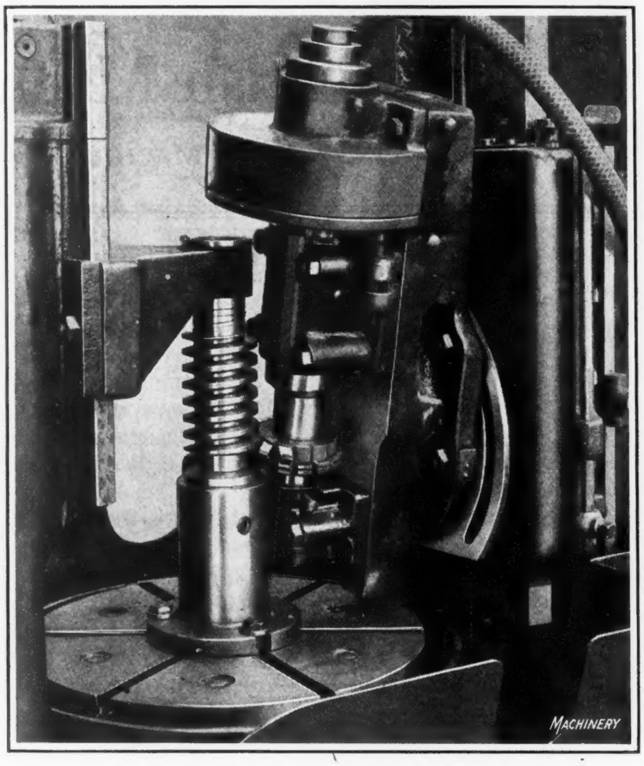


Fig. 2. Single-threaded Worm and Set-up for hobbing the Threads

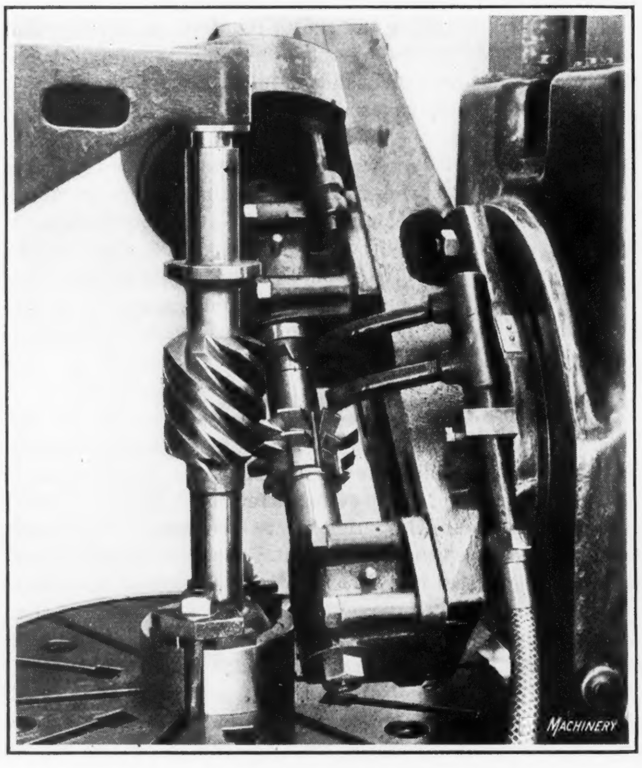


Fig. 3. Multiple-threaded Worm being hobbed with Hob of Special Design

The hobbing method is also adaptable for roughing worm threads that are to be subsequently heat-treated and then ground to correct errors due to distortion. In roughing with this method, the spacing of the teeth on the worms is very accurate, and permits a high degree of precision in the final grinding operation. Fig. 3 shows the rough-threading operation on an alloy steel seven-threaded worm, the outside diameter of which is 4.10 inches; width of face, 4½ inches; and linear pitch, 1.37 inches. The time required to thread this worm was sixty minutes, floor to floor. The threads are, of course, subsequently finished by grinding.

Another example illustrating the rate of production obtainable by this method is the threading of an alloy steel quadruple-threaded worm, having a 2.8-inch outside diameter; a 4½-inch face; and a 1.06-inch linear pitch. Worms of this type were produced at the rate of eight minutes each, floor to floor. The worm hobbing process has proved very successful in the threading of multiple-threaded automobile steering worms. These worms are produced with a very accurate linear pitch and excellent finish. A double-threaded steering arm for a well-known motor car is 2.09 inches outside diameter, 1⅝ inches face width, and has a linear pitch of 0.52 inch; quantities of these parts were produced by hobbing at the rate of fifteen minutes each, floor to floor.

The accuracy of worms produced by the hobbing method as outlined is due to the nature of the cutting action which is progressive and continuous and which produces multiple-threaded worms of accurate lead—an essential feature in worm drives.

* * *

MACHINING MOTOR PISTONS

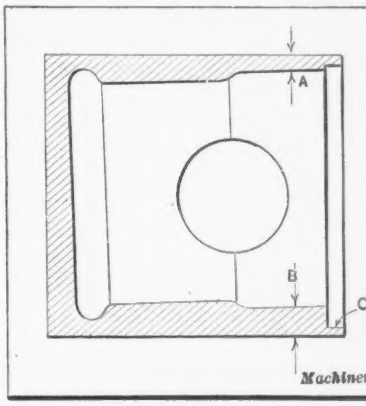
By ALBERT A. DOWD

The writer read with considerable interest the description of the process of machining motor pistons which appeared on page 878 in May MACHINERY. Some of the machining operations described in this article, however, are not carried out in accordance with the practice generally found most satisfactory by the writer, who has handled a great number of automobile pistons of various kinds in the last few years. The following suggestions relative to improved methods of machining automobile pistons are based on the facts obtained in developing methods for machining various types of pistons. It should be borne in mind that the design of a piston and the accuracy of the piston castings are factors to be taken into consideration, and it often happens that a method that proves entirely satisfactory for one kind of piston will be unsatisfactory for another. The practice of holding the piston by the outside diameter and facing the end and boring the inner surface in the first machining operation, as described in the article in May MACHINERY, while in use by some manufacturers, is not generally successful on account of the difficulty of preserving the required uniform thickness of walls.

An exaggerated example of the results often obtained in chucking the work from the outside for the first machining operation is shown in the accompanying illustration. It will be seen that while the bored and reamed open end of the piston at *C* is concentric with the outside of the rough casting, it is by no means true with the inside or cored section. Therefore, if the finished part of the open end is used as a locating point for any succeeding operations, the distribution of metal in the piston wall will be very uneven. For instance, the wall may be too thin at *A* and too thick on the opposite side at *B*; consequently, a number of pistons machined in this way when completed would vary appreciably in weight, and would be difficult to assemble in such a way as to balance the motor properly. However, if the work is held for the first machining operation by the inside cored surface, and the outside surface is rough-turned at this time, the outside and inside surfaces will be concentric and the walls of uniform thickness.

After the piston has been rough-turned, it can be held on the outside by means of soft jaws, while boring and reaming the open end. As the core of a piston is quite heavy, and as it has no support at one end, it is difficult to keep it properly located in the central position, and as a matter of fact, it is more than likely to be out of line when the casting is made. For this reason, most manufacturers of pistons agree that the proper method of holding a piston for the first machining operation is by the inside cored surface, using some type of expanding pin chuck for the work. It is possible, however, to locate a piston from the inside by a special device placed on the turret of a turret lathe. By using a device of this kind in connection with a special floating jaw chuck on the machine spindle, the work can be gripped by the outside in the floating jaws of the chuck so that it will be held in the proper relation with the cored inner surface. The locating device can then be withdrawn and the boring and reaming of the open end accomplished with the assurance that it will be true with the cored section.

In regard to the drilling of the wrist-pin hole, it is usually considered better to drill this hole from each side, and some manufacturers use a special drilling machine for this purpose which drills from both sides simultaneously. If this is done, there is less likelihood of the drill running out of line and producing a hole which is not square with the outside of the piston. The writer's objection to the method described in the article previously referred to is that the drill is unsupported for a considerable distance beyond the drill jig bushing at the time it comes in contact with the wrist-pin boss at the lower side of the piston.



Piston having Core out of Line with Outside Surface

* * *

NEW BOOK ON DIE-CASTING

DIE-CASTING. 108 pages, 6 by 9 inches; 70 illustrations. Published by THE INDUSTRIAL PRESS, 140-148 Lafayette St., New York City. Price, $1.

The die-casting industry, like most other industries, has been developed gradually through a period of many years, although the commercial application of this process for producing various kinds of castings is comparatively recent. The result is that developments and changes occur quite rapidly, and work formerly considered impracticable for production by the die-casting process is now handled successfully. It is likely that even greater advancements in the development of this method of producing castings may occur within the next few years. Whatever the future developments may be, the industry has made enormous strides since the introduction of the first machines designed for die-casting on a commercial basis. Semi-automatic and automatic machines have replaced many of the early hand-operated types; great progress has been made in the use of different alloys; plants devoted entirely to the manufacture of die-castings have been established; and an industry of great value in certain lines of manufacture has been created. This treatise (compiled mainly from articles written for MACHINERY by E. F. Lake and Chester L. Lucas) deals with the origin, development, and advantages of the die-casting process, the different machines and alloys now used in the production of die-castings, the construction of die-casting dies, and the commercial application of this efficient and accurate method of producing castings.

The German Machine Tool Industry

From MACHINERY'S Special Correspondent

Berlin, July 8

REPORTS relating to the German machine tool industry indicate that the supply of raw materials has been adequate to meet the demand during the last few months, but the supply of coal is still a limiting factor in industrial work. The orders on hand in the machine tool industry are comparatively few, and many plants are closed for from one to three days a week. There have been practically no labor troubles, and there is an increasing willingness on the part of the workers to perform their duties. In fact, in cases where orders are of an urgent nature, the men have declared themselves ready to work over-time.

Foreign business is now almost nil for several reasons: First, the uncertainty about the plans of the German Government after the acceptance of the London ultimatum prevented the German exporter from making plans with any degree of security. Second, the position of foreign business is entirely unsatisfactory, mainly because of protective legislation in many foreign countries. A great many of the countries have increased their tariff duties, and some have even introduced a special duty on imports from countries having a low exchange rate. Finally, Germany suffers the same as most industrial nations in consequence of the crises in the world's markets, where prices have been rapidly reduced and where other nations are becoming stronger competitors of German manufacturers. To export to the countries which have a special import duty becomes impossible.

Prices have fallen considerably, and in many cases manufacturers are selling at a loss. They prefer to do that rather than to have their plants entirely idle. The outlook for the German machine tool manufacturers is very dark at present. There can be no expectation of an increase in domestic orders for some time to come, and the uncertainty as to the amount of new taxation makes it impossible to lay any plans, business men preferring to quietly await developments. The heavy taxes that must be levied and the export duties that will be required will also reduce the competitive strength of German industry.

According to the official census covering exports and imports of machine tools during the first eight months of 1920, just issued, it appears that 58,500 tons of machine tools were exported as compared with 55,400 tons in 1913. The imports amounted to only 820 tons.

German Association of Machine Tool Builders

The report of the German Association of Machine Tool Builders for the business year 1920 calls attention to the disappointment of those who thought that the recovery of Germany would be rapid. The tremendous increase in production facilities caused by the war brought about overproduction in machine tools; while on the other hand, a great number of second-hand machine tools were placed on the market. At the end of 1920 there was a marked decrease in the prices of materials, but any advantage from this source was lost through the continuous rise in wages in the meantime. In 1920 there was a fair export business facilitated by the low exchange value of the mark, even though the domestic business was small.

The formation of groups within the association, which was started last year, has made further progress. The fundamental object of the groups is to facilitate price agreements and cooperation in regard to manufacturing programs. This plan can be successful only where the group includes makers of machines of the same kind. The idea has proved very valuable; meetings within the smaller groups take place frequently, and by these conferences plans for manufacturing programs have been effectively promoted. Of course, larger meetings are held whenever the interests common to all groups need to be considered.

Machine Tool Exhibitions

Another subject dealt with by the association is that of machine tool exhibitions. The experience with the fair at Leipzig has proved this to be a satisfactory means for advertising the German machine tool industry. At the fair last spring there were 145,000 visitors, among them many thousand foreigners. In 1922, sixteen thousand square feet of space will be taken at the exhibition, and the association will also take part in the 1923 fair, at which time it will be determined whether this fair will become a permanent institution or not. The exhibitors report that they obtained many good prospects as a result of the fair, but direct sales were made only in a moderate degree and restricted mainly to well-known makes of machines. The duration of the fair has been limited to two weeks for the future.

Organization of German Trade Associations

The German Precision Tool Association and the German Twist Drill Association have each engaged a business manager of their own; and secretaries have been appointed for the twenty-seven groups of the German Machine Tool Builders' Association. Altogether, in all the offices of the association, ninety-nine persons were employed at the end of 1920. Of these, three were engaged in connection with the exhibition, thirty-four on import and export trade, eleven on consolidations, and nine in connection with research work. The association has acquired an office building of its own. For the problems and the work of reconstruction a new department has been opened, which has a chief with five assistants.

The association now has 392 members, exclusive of the German Precision Tool Association, which has 121 members, and the German Twist Drill Association, which has 23 members. The Association for the German Works for Abrasives has 34 members, and the Research Society, 76.

Present Prices of Machine Tools

It is reported that the German machine tool industry will have to be ready to face very keen competition from France, as the French machine tool industry has been highly developed and is placing machinery and tools of good quality on the market at low prices.

Notwithstanding the depression in the industry, there appears to be no likelihood of a reduction in prices among the German manufacturers. The dealers show a readiness to sell at reduced figures, frequently lower than those quoted by the makers. As examples, it may be mentioned that a 40-inch vertical boring and turning mill sells for 37,000 marks ($518, present exchange); a 48-inch lathe, 19,000 marks ($266, present exchange); and a hand-feed milling machine, 4100 marks ($57, present exchange.)

A Berlin agency of the Soviet Government in Russia has been created for the metal-working and mining industries. This agency has power to make all purchases in Germany for the metal-working and mining industries in Russia.

NEW MACHINERY AND TOOLS

THE COMPLETE MONTHLY RECORD OF NEW AMERICAN METAL-WORKING MACHINERY

The New Tool Descriptions in MACHINERY are restricted to the special field the journal covers—machine tools and accessories and other machine shop equipment. The editorial policy is to describe the machine or accessory so as to give the technical reader a definite idea of the design, construction, and function of the machine, of the mechanical principles involved, and of its application.

Stevenson Multiple-tool Gear Shaper

A NEW type of gear-cutting machine, known as the Stevenson multiple-tool gear shaper, which differs from the usual types of gear-cutting machines in that it cuts simultaneously all or a number of teeth in a gear or similar product, as distinguished from cutting one tooth at a time, has been developed by the Stevenson Gear Co., Indianapolis, Ind. The distinctive member of this machine, which is shown in Fig. 1, is a special tool-head consisting primarily of a series of radially disposed tools, spaced about the circumference of the blank to be cut. The machine operates in the same manner as an ordinary vertical shaper, except that the tools are held in a stationary position, and the gear blank is reciprocated past them.

General Features of Construction

The frame of the machine is a casting of rectangular box section with a vertical cylindrical portion at one end. A ram that carries the work-arbor is mounted in the center of this cylindrical part, and the tool-head is mounted above the ram. A crankshaft which drives the ram has bearings near the top of the rectangular section, and is provided with an adjustable head at the end next to the ram; it is driven through back-gears by an individual electric motor. The work-arbor fits a socket in a spindle inside the ram, the spindle being free to rotate independently of the reciprocating motion imparted to it by the ram. An intermittent indexing movement is imparted to the spindle after each cutting stroke, the purpose of which will be described later.

Construction of the Tool-head

The top of the tool-head is shown in Fig. 2 and the bottom in Fig. 3, while in Fig. 4 the bottom is removed to expose the principal parts of the mechanism. The tool-head consists essentially of a flat steel disk, 3 feet in diameter, which is provided with a hole at the center and a number of radial grooves in its face in which the tool bits are held. Feeding movements are imparted to the tools by an annular sectional cam-ring, the tools being gradually fed inward between each traverse of the gear blank past them until the full depth of the tooth has been cut. At the completion of each stroke of the ram, the gear blank is indexed a space equal to one tooth, thereby presenting a different tool to each tooth from the one which made the previous cut.

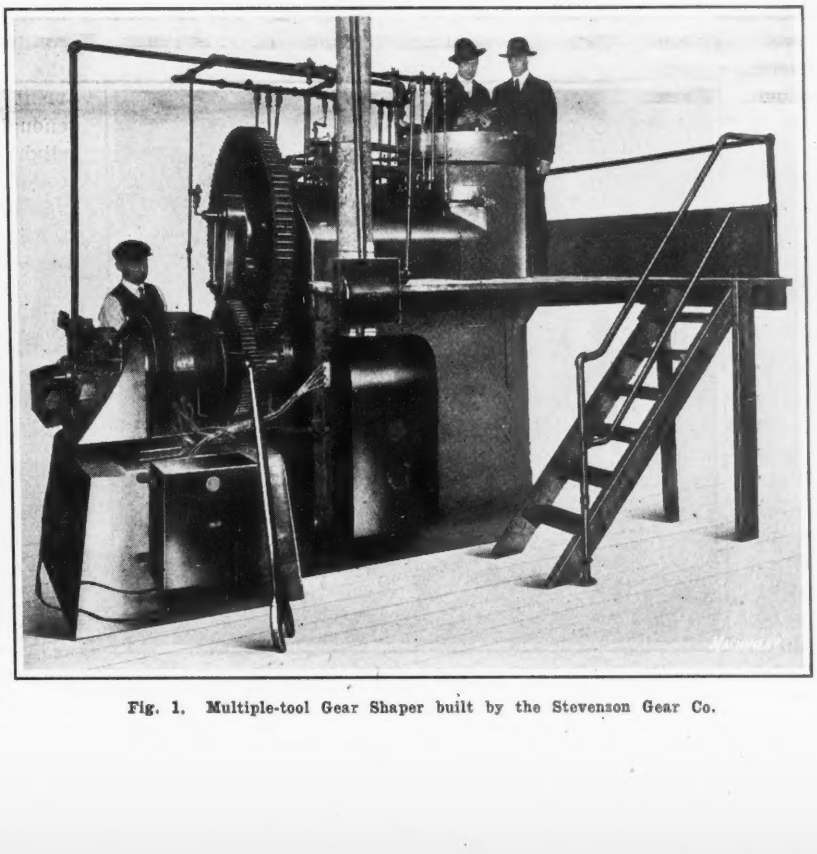


Fig. 1. Multiple-tool Gear Shaper built by the Stevenson Gear Co.

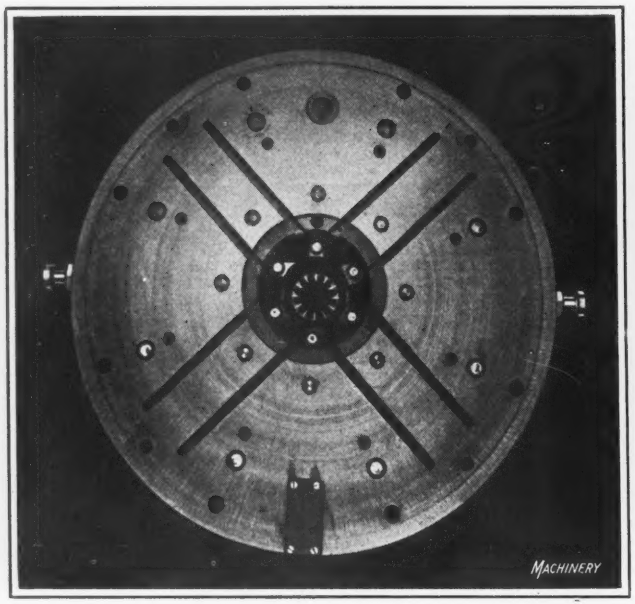


Fig. 2. Top of Tool-head as it appears when mounted on the Machine

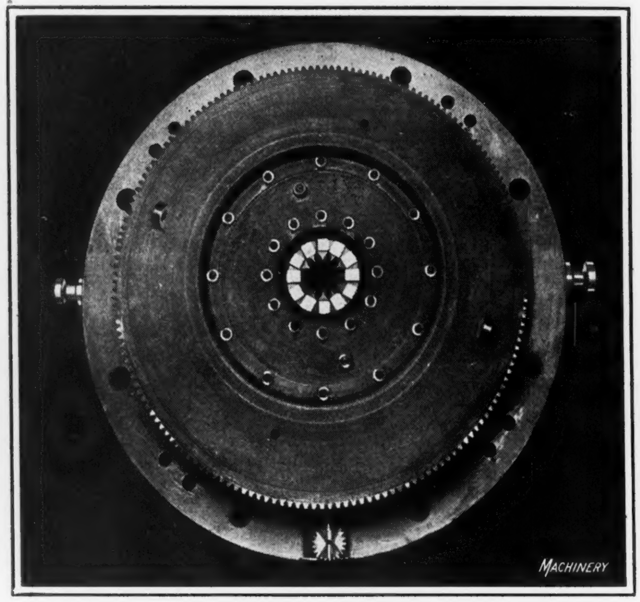


Fig. 3. Bottom of Tool-head showing Ring Gear used to clamp Tools

After the tools have been fed in to full depth, they are held in that position while the cutting process continues until the gear has been indexed one complete revolution, so that each tool takes one last cut on each tooth. This final complete indexing insures a uniformity of tooth spacing on the gear equal to that of the indexing mechanism. Uniformity of the tooth form is secured, even though the tools themselves may not be uniform, because if any tool is longer or wider than any other tool, even though it be only a thousandth of an inch, that portion of it which is longer or wider will take a last cut on the corresponding portion of each tooth in the gear, and thereby eliminate any variation which may have been caused by previous cuts.

When the tool-head is mounted on the machine, the only working parts to be seen are the points of the tool bits at the center and the small depth adjustment dial seen near the top in Fig. 2. The four pairs of T-slots on the face of the tool-head are useful for attaching a piloting device used on extremely long and slender arbors which need an outer support. Two tool-heads are provided for each machine, so that while one is in use on the machine, the tools of the other may be sharpened and reset, ready for use when the tools in operation become dull. The tool-head is held in place by eight studs and nuts in such a way that it can be readily removed and replaced. This arrangement permits a practically continuous operation of the machine. When a tool-head is taken off, it is turned bottom side up on trunnions. The clamping gear and plate are then removed in order to expose the tools and feeding mechanism, as illustrated in Fig. 4.

Tools and Actuating Cams

The tools are rectangular in section except for the lower side which is in the form of a vee. The gear tooth profile at the inner end of each tool is backed off to permit sharpening without changing the form. The outer end of each tool is ground to the radius of the cam surface against which it bears. A small pin near the back end fits in a groove of the cam and keeps the tool in close contact with the cam surface. The individual cam sections are mounted on a large ring, being attached by T-bolts that fit a circular slot in the ring. The tools are adjusted for depth independently by moving the cam sections individually along the T-slot relative to the cam-ring and each other. Feeding movement is imparted to the cam-ring through the two idler gears seen near the bottom of the tool-head in Fig. 4.

Fig. 4. Tool-head with Bottom removed to expose the Tool-actuating Mechanism

The final depth to which the tools are fed is determined by an adjustable stop that limits the rotary feeding movement of the cam-ring. As the feeding mechanism is spring-actuated, the position of the depth-controlling stop can be varied within reasonable limits without necessitating a resetting of the feeding mechanism. This is particularly desirable during the operation of the machine in cases where the tools may not have been set to exactly the right depth in the beginning, or in cases where the keen edges of the tools wear and they begin to cut uneven or over-size gears long before they are actually dull. The dial which controls this adjustment has been previously referred to.

Tool Feeding, Clamping and Indexing Mechanisms

In order to provide relief for the tools on the back stroke of the ram, a reverse feeding movement is imparted to the cam-ring. Then, before the beginning of the cutting stroke, the forward feeding movement of the cam is great enough to compensate for the slight reverse movement for relief and also to provide the necessary additional feed for the depth of the cut. The large gear and plate seen in Fig. 3 are used to clamp the tools intermittently for the cutting stroke. The gear member is free to rotate about the central plate, and a rotary reciprocating motion is imparted to it by a cam-operated segment so as to clamp the tools.

The feeding and clamping mechanism is shown in Fig. 5. Segment *A* which controls the feeding of the tools swings about a central stud as a fulcrum, and is moved directly by a cam. This cam is rotated intermittently by

a ratchet on which it is mounted, and can be adjusted to produce various feeding motions. The cam has a long gradual slope for the feeding movement and a sharp one for quickly returning the tools to their starting position at the completion of the cutting operation. The slight reverse movement for furnishing the tools with relief, previously referred to, is effected by mounting the fulcrum stud eccentrically on a shaft which is given a partial rotation by a face-cam on the large driving gear. Gear segment *B* is the one used in clamping the tools. It is actuated directly by a push-rod in contact with another face-cam on the large driving gear. The releasing movement is accomplished positively, but the clamping movement is effected by means of a spring in order to eliminate breaking some part, which might occur if the clamping mechanism were too tight.

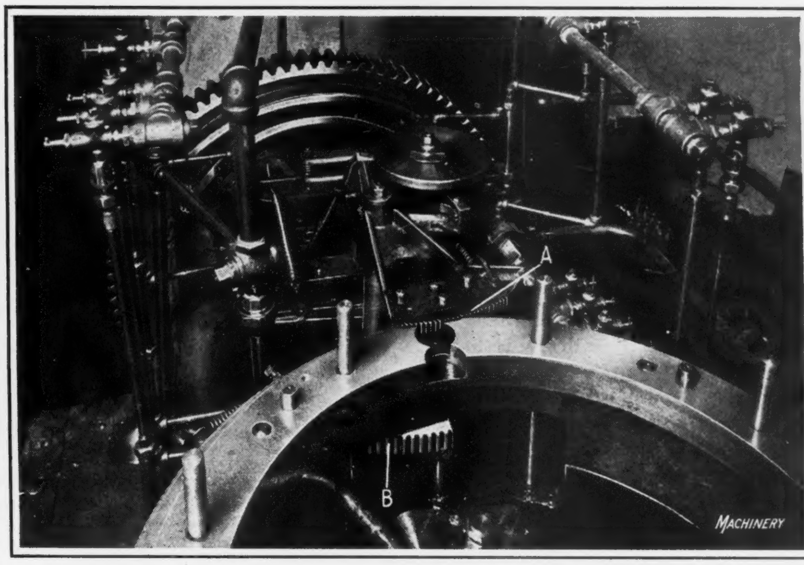


Fig. 5. View taken with Tool-head removed so that the Tool Feeding and Clamping Mechanism can be seen

The indexing mechanism is shown in Figs. 6 and 7. It consists of a split-bushing guide, one half of which is attached to the ram spindle, and the other half to a revolving drum on which is mounted a worm-gear driven by a worm and an intermittent gear train. The intermittent indexing movement is derived from a Geneva wheel, and is transmitted through a set of change-gears to the worm and worm-gear. By varying the ratio of the change-gears, indexing movements for any desired number of teeth may be obtained. Minute angular adjustments of the spindle position varying by one second of an arc, for locating keyways, the teeth of cluster gears, etc., are obtained by means of a differential clutch between the worm and worm-shaft.

The main crankshaft of the machine is connected to a large back-gear by a quick-return crank of the drag link type, as will be seen by referring to Fig. 1. This crank imparts a slow motion to the ram during the cutting stroke and a quickly accelerated motion for the return stroke. The driving motor is mounted on a sliding base, and drives through a single set of speed-change back-gears. The drive for the indexing mechanism is taken directly from these gears. A pump for circulating the cutting oil is driven from a small sprocket on the end of the motor shaft opposite the driving pinion. The motor is controlled by a push-button switch, an automatic compensator, and a solenoid electric brake.

The Work-arbor

The work-arbor is provided with a thrust collar and a taper shank to fit the socket in the ram spindle. The thrust collar prevents the shank from being thrust too tightly into the socket. Gear blanks are put on the arbor and fastened in place by a nut while the arbor is held in a vise-like fixture attached to a bench at the side of the machine. After loading the arbor, it is dropped into the spindle socket and the machine is ready to work. The thrust of the cut forces the arbor back into the socket until the shoulder is reached. The tight fit of the taper shank is sufficient to prevent the arbor from turning under the pressure of the cut, but it is not great enough to make it difficult to remove. While one arbor of gears is being cut, another arbor is loaded with blanks. As soon as the work on the arbor in the machine is finished, the operator stops the machine and presses a conveniently located foot-pedal, which, by means of a long bar passing through a hole in the center of the spindle, knocks out the arbor of completed gears. He then drops the arbor with uncut blanks into the socket, touches the starter button, and the cutting operation again proceeds almost without interruption. The entire operation of stopping the machine, changing the arbors, and starting again, occupies less than one-half minute. The machine illustrated is 7 feet high, weighs 17,000 pounds, and when operating at full capacity is driven by a 100-horsepower motor. It has a capacity for gears 12 inches diameter, 6-inch face, and 4 diametral pitch. The machine will also be built in other sizes.

Advantages of the Machine

In cutting some gears, it is desirable to use as many tools as there are teeth in the gear. In others it is more practical to use only half or a third as many tools as there are teeth. With this arrangement a tool-head equipped with

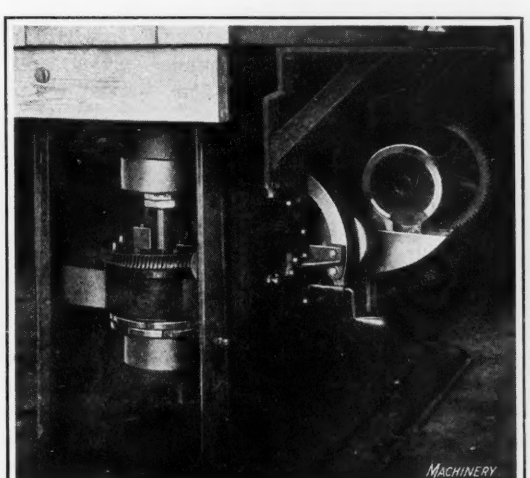


Fig. 6. Mechanism provided for indexing the Work after the Completion of Each Stroke

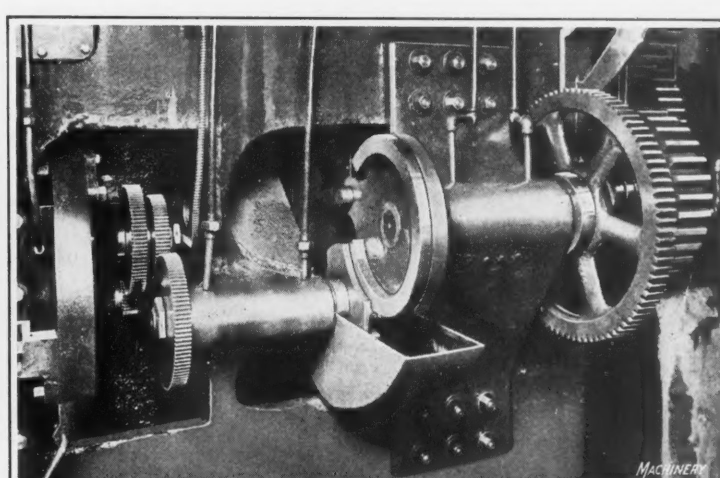


Fig. 7. Close-up View of that Portion of the Indexing Mechanism that is on the Side of the Machine

any number of tools can cut gears having any number of teeth which is a multiple of the number of tools used. Thus a spacing plate having ten tools could be made to cut ten, twenty or thirty teeth, etc. In a case like this, if it is desired to cut a number of teeth greater than the number of individual tools which can conveniently be placed within the space, a gang tool is used to cut two or more teeth. This arrangement is particularly advantageous in cutting gears having a large number of very fine teeth, on account of the fact that although the amount of power required for the cutting of all the teeth is small, it would, nevertheless, be practically impossible to use as many individual tools as there are teeth in the product. Where it is desired to cut a gear having an odd number of teeth, and it is not practicable to use a tool for every tooth, ten tools may be used.

In some cases, every other tool is made in the form of a roughing tool, either a square-nose gashing tool or the usual type of stepped roughing tool. These tools are so adjusted that they will remove most of the stock from the tooth space. The alternate tools are then made in the usual type of finishing tools and take the last few finishing cuts. At other times, a special cam is provided for one tool, so that this tool is held back during the stock-removing cuts and is then fed forward ahead of the other tools to take the finishing cut on all the teeth.

This gear-tooth shaper is also adapted for the production of other cylindrical products having teeth or grooves, such as sprockets, splined shafts, reamers, taps, milling cutters, saws, ratchets, etc. The machine may also be used for cutting gears made of different materials, such as laminated gears composed of sheets of steel, brass, rawhide, fiber, etc.

POLIAKOFF MILLING MACHINE DYNAMOMETER

To enable an accurate determination of the different pressures exerted by the cutter of a milling machine on the work and on the working parts of the machine, the Cincinnati Milling Machine Co., Cincinnati, Ohio, has placed on the market the Poliakoff milling machine dynamometer. This dynamometer is equipped with dial gages which permit a direct reading of the vertical pressures on the work and either the longitudinal or the transverse pressures relative to the table of the machine. It thus furnishes a means of ascertaining the difference in the pressures exerted by cutters of various types when taking duplicate cuts, and should prove valuable in supplying information to designers of milling cutters, fixtures, and machines. It should also be of assistance to the designers of parts to be milled, because in the final analysis the pressure of the cutter is first exerted on the work and then transferred to the milling fixture and machine. In experimental shops, laboratories, and technical schools it may be used to determine the efficiency of machines.

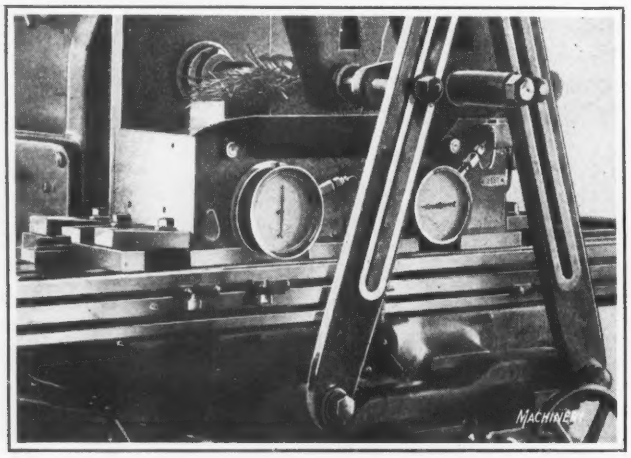


Fig. 1. Milling Machine Dynamometer placed on the Market by the Cincinnati Milling Machine Co.

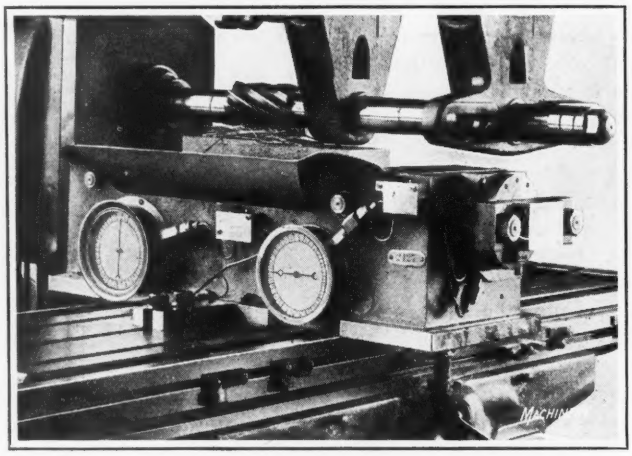


Fig. 2. Poliakoff Dynamometer being used to determine the End Thrust of a Cutter

The dynamometer consists essentially of a work platen supported by a baseplate which is bolted to the table of the machine. In Fig. 1 the device is shown mounted on a milling machine, and a heavy cut is being taken on a piece of steel. The vertical downward and upward pressures of the cutter are read directly from the left-hand dial, while the longitudinal pressure relative to the table is read on the right-hand dial. When it is desired to obtain the transverse pressure, that is, the pressure in line with the arbor of the machine, the dynamometer is mounted on the table as shown in Fig. 2, and the pressure ascertained from the right-hand dial. This arrangement enables the end thrusts of spiral- and face-milling cutters to be determined.

The work platen of the dynamometer is supported at the ends by wide plate fulcrums, the lower ends of which rest on levers which carry a definite portion of the vertical load on the platen to a hydraulic chamber located centrally beneath the platen. This chamber is connected with the left-hand dial gage, the latter being graduated to indicate the pressure in pounds. The horizontal pressures on the platen are transmitted through bars, which are flexible vertically, to the cross-head seen at the right-hand end of the dynamometer in Fig. 2. This cross-head transmits the load to a hydraulic chamber between the cross-head and the end of the main frame of the dynamometer, the hydraulic chamber being connected to the right-hand dial gage. Heavy springs place initial loads on each chamber.

The plate fulcrums which carry the loads to the levers, as previously mentioned, are so constructed as to be rigid against vertical and cross loads, but flexible to longitudinal loads, and the bars to the cross-head are flexible to vertical loads so that neither of the two registering mechanisms of the dynamometer interferes with the action of the other. Guards are provided so that lubricant may be supplied to the cutter. The dynamometer has a capacity for withstanding longitudinal loads up to 25,000 pounds, vertical downward pressures up to 10,000 pounds, and vertical upward pressures up to 7000 pounds. The working surface of the platen is 16 by 10 inches, and it is provided with three T-slots. The base is 35 inches long and 14 inches wide, and the height of the platen above the bottom of the base is 8 inches. The dynamometer is not confined to investigations of pressures on milling machines, but can also be used on planers, shapers and, with modifications, on drilling machines.

KNIGHT ONE-HAND ELECTRIC DRILL

The Knight Engineering & Sales Co., Los Angeles, Cal., has developed a one-hand electric drill for drilling small holes up to and including 1/4 inch in diameter. The tool has been given the trade name of "One-Hand-Y" drill. It is one of the lightest of its class ever placed on the market, and is designed for drilling holes for oiling purposes, cotter-

pins, nameplates, etc. It will prove especially useful in garages and sheet-metal shops. The housing of the drill is an aluminum die-casting, and has a pistol grip designed to fit the hand. The grip is in a direct line with the chuck, thus giving a straight-line pressure on the drill bit and eliminating side strains. A switch-button, operated by the thumb, controls the power, and so the motor does not run unless desired.

The drill is equipped with a Westinghouse motor intended for operation on either alternating or direct current of 110 voltage, and so can be connected to a lamp socket. The chuck spindle has a bronze gear that is driven from a pinion integral with the hardened and ground armature shaft The spindle has a large bronze bearing. The thrust bearing consists of a loose steel ball in bronze bushings. A knurled nut on the extended end of the armature shaft furnishes a quick and simple method of holding the chuck spindle stationary when it is desired to remove a drill bit. The drill is regularly equipped with six feet of cord and a three-jaw chuck. It is 8 inches long, and weighs about 3 pounds.

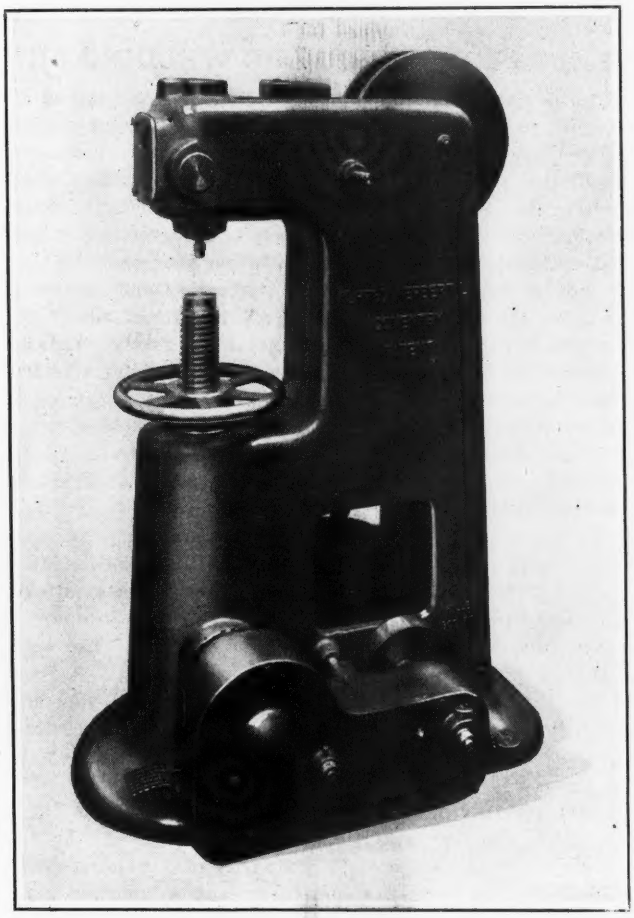


Fig. 1. Power-operated Brinell Hardness Testing Machine built by Alfred Herbert, Ltd.

ALFRED HERBERT HARDNESS TESTING MACHINES

Two machines employing the Brinell principle of testing the hardness of metals have been developed by Alfred Herbert, Ltd., 50 Church St., New York City. The outstanding features of the machine shown in Fig. 1 are its operation by power, which eliminates physical exertion on the part of the operator; the automatic application of pressures on parts to be tested; and the uniformity of the periods of pressure applications. The ball through which pressure is applied to a specimen is 10 millimeters in diameter and is used with the standard pressures of 500 and 3000 kilograms, according to the kind of material being tested

The ball is carried by the lower end of a vertical plunger, the weight of which is neutralized by a light spring. This plunger moves upward a slight amount when a specimen is raised into contact with the ball, the pressure between the specimen and the ball being weighed through a lever and a weight which becomes poised when the full pressure is reached. The point of application of the pressure on the lever is a hardened steel roller. At the other end of the lever is a spur gear segment which meshes with a pinion keyed between two sheaves. A wire cord with its ends attached to the sheaves, passes around them and also around a third sheave that is attached to an adjustable weight inside the column. An indicator located at the front of the machine shows when the weight is poised and the full load is on the specimen. Openings are provided in the column to permit the changing of weights to apply either a 3000 or 500 kilogram load as required.

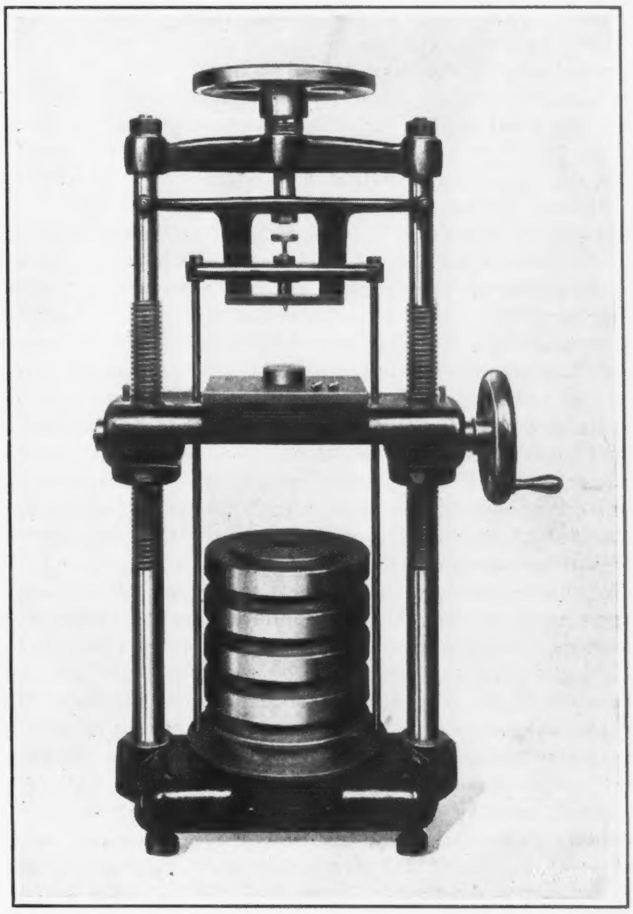


Fig. 2. Machine developed by Alfred Herbert, Ltd., for testing the Hardness of Thin Specimens

The object to be tested is placed on a flat anvil, which rests on a spherical seat on the top of a vertical screw. The anvil is elevated by a handwheel, in order to bring the specimen in contact with the ball. The spherical seat on the screw has a recess at the center which enables the proper location of V-blocks or other special forms of support required for the work when these supports are provided with a suitable projection. The elevating screw occupies an axial position in a vertical cylindrical ram. A slight upward movement of this ram forces the work against the ball and causes the application of the pressure, the latter being regulated and resisted by the poised weight of the weighing element.

The lower end of the ram carries a roller which rests on a cam that makes a single revolution for each test. The contour of this cam is such that the load is applied gradually, maintained for the predetermined period, and then removed. Rotation of this cam is effected by a worm-wheel and worm which are driven through spiral gearing and

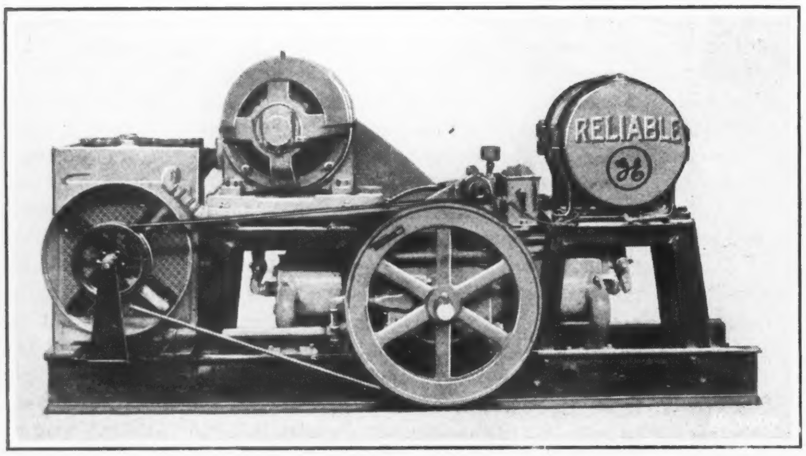


Fig. 1. Portable Medium-duty Arc Welding Equipment made by the General Electric Co.

shafts from a single driving pulley located near the base of the machine. The mechanism is engaged by depressing a pedal, and is automatically disengaged at the conclusion of a cam revolution. The maximum height between the ball and the anvil is 10½ inches; the distance from the center of the ball to the face of the column at the gap, 9½ inches; and the approximate weight of the machine, 1680 pounds.

Another Alfred Herbert hardness testing machine is illustrated in Fig. 2. The essential difference between this machine and other Brinell machines is not in principle, but in the size of the pressure ball and in the amount of the load applied. The machine was developed to enable an accurate determination to be made of the hardness of thin specimens and finished articles that cannot be subjected to the pressure of ordinary testing machines, either because of their small size or because of the injury caused by making a comparatively large impression. The balls used on this machine in ordinary practice are 1 and 2 millimeters in diameter, and loads up to 50 kilograms are applied. However, balls 5 millimeters in diameter are also supplied for use in testing extremely soft metals.

With this machine thin-walled tubes and other hollow forms may be tested without internal support, tests may be made on loaded small-arm cartridge cases without necessitating the removal of the bullet or charge, articles may be tested by an impression so small as to be imperceptible to the naked eye, the hardness of wire can be tested at successive stages of the drawing process, and the hardness of the skin of casehardened work may be determined. The hardness numbers are calculated in the same way as in ordinary Brinell tests, the diameter of the impression being measured by means of a microscope designed especially for use with the machine.

The base of the machine is provided with leveling screws and supports two threaded columns on which is mounted a table that holds the specimens to be tested. This table is adjustable up and down on the columns by means of a handwheel. At the center of the cross-head mounted on the top of the columns, is a fine-pitch screw which can be raised and lowered by means of the handwheel. The lower end of the screw carries a suspended casting which is prevented from rotating by arms that bear against the columns. From this suspension is hung a member on which the ball holder is mounted and to which are attached two rods that carry the weights. In using the machine, a size of ball and holder is selected to suit the character of the material to be tested, and the ball is attached to the holder by means of rubber. This method of holding renders the changing of balls an easy matter.

After the ball and holder have been mounted in place, the table is set to the required height, the work is placed in position by using a supporting block or fixture, if necessary, and the upper handwheel is slowly turned until the ball rests on the specimen. The loading member is free and disconnected from the suspension, and so the entire weight rests on the specimen. The upper handwheel is then turned backward to remove the weight from the specimen, after which the latter is removed, the diameter of the impression measured, and the hardness determined. The over-all height of this machine is 36 inches; the size of the work-table, 7½ by 6 inches; the maximum height between the work-table and the ball when using a weight of 50 kilograms, 8 inches; and the weight of the machine, 210 pounds.

GENERAL ELECTRIC ARC WELDING SETS

Two portable arc welding sets driven by gas engines and intended for use in odd places about industrial plants where the amount of work is not sufficient to deserve a permanent installation have been placed on the market by the General Electric Co., Schenectady, N. Y. The sets are particularly suitable for use in places where electric current is unavailable. One set was developed for medium duty, and the other for heavy duty. The medium-duty equipment, shown in Fig. 1, is intended particularly for intermittent work. The generating unit consists of a generator directly connected by means of a flexible coupling to a four-cylinder, 20-horsepower gasoline engine. The engine, radiator, generator, and welding panel are assembled on a cast-iron base, which is mounted on wooden skids. The gas engine is of the overhead valve type, and the cylinders are cast en bloc with the upper half of the crankcase.

The generator is self-exciting and regulating, and gives a practically constant energy throughout the working range. It gives a "no load" voltage of 60, which is automatically decreased to the proper welding voltage when the arc is struck, this voltage usually being from 18 to 20. The speed of the generator is 1200 revolutions per minute. A panel carries the generator field rheostat and series field dial switch by which the current can be adjusted from 200 to 75 amperes. This equipment is 86 inches long, 28 inches wide, and has a net weight of approximately 2000 pounds.

The heavy-duty arc welding equipment is shown in Fig. 2. This outfit can be arranged to supply either one or two welding currents. It consists ordinarily of a 20-horsepower, two-cylinder gas engine, a generator, and a welding panel, all of these being mounted on a structural steel base. The

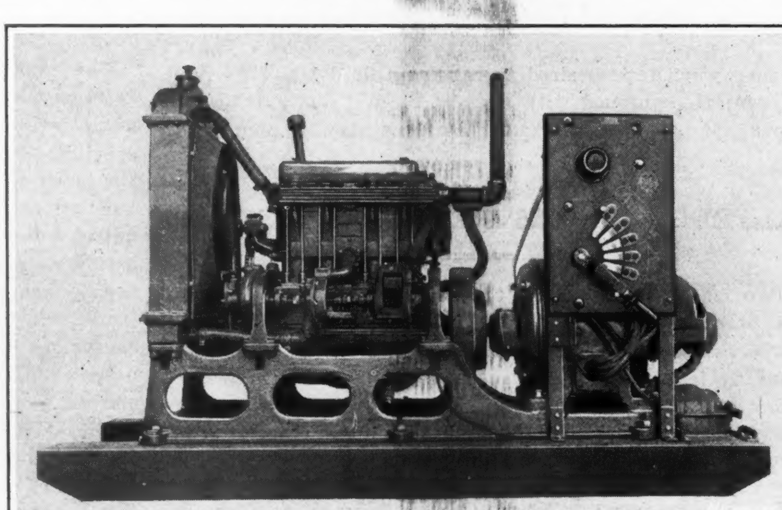
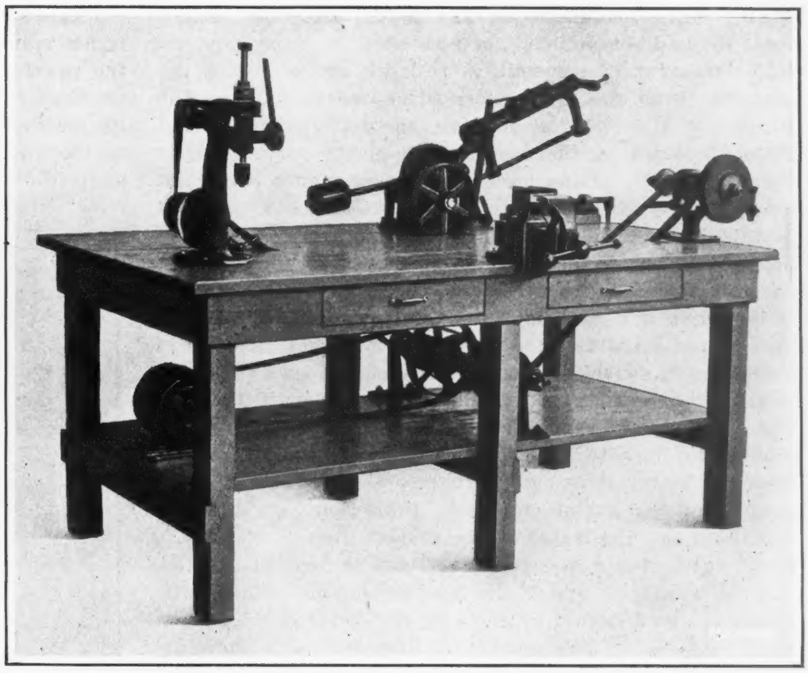


Fig. 2. Heavy-duty Arc Welding Set made by the General Electric Co.

net weight of a single-current equipment is 2400 pounds, and that of a double-current equipment is 3200 pounds. The gas engine of this equipment is designed for continuous operation, and will run on kerosene, gasoline, or natural or artificial gas. The generator is driven by a silent chain running in oil, and, except for the speed, it is similar to that furnished with a medium-duty outfit. The generator runs at the rate of 1750 revolutions per minute. An ammeter is mounted on the panel of this welding set.



Combination Work-bench made by the Myers Machine Tool Corporation

MYERS COMBINATION WORK-BENCH

The Myers Machine Tool Corporation of Columbia, Pa., is making a combination work-bench designed to meet the requirements of automobile repair men, mechanics, and inventors who desire to build experimental equipment. The bench is shown in the accompanying illustration, from which it will be seen that it is furnished with a number of pieces of handy equipment. These consist of a No. 2 geared automatic hacksaw provided with a vise, a 10-inch sensitive drilling machine equipped with a table and a 3/8-inch chuck, a No. 6 grinder head with emery and muslin polishing wheels, and a 4-inch machinists' vise having hardened steel jaws.

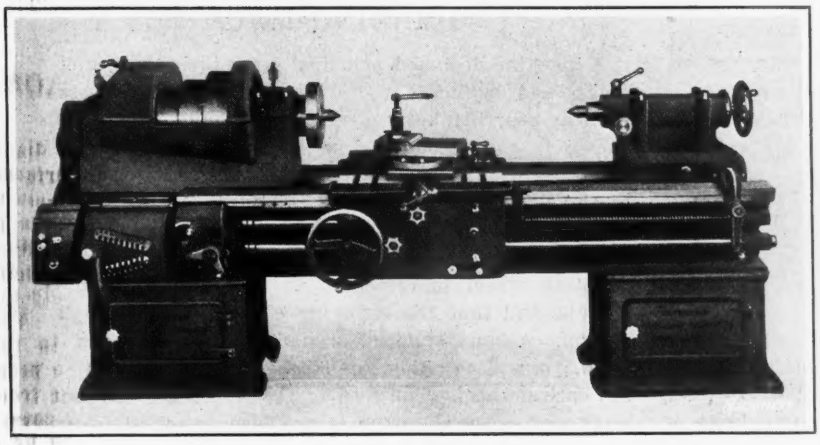
The different pieces of equipment are driven by a 1/2-horsepower alternating-current motor running at 1750 revolutions per minute. The motor drives through a countershaft that permits individual or collective use of the different machines without requiring the changing of belts. The table is 78 inches long, 39 inches wide, and 33 inches high. It is provided with two drawers for the storing of small tools, etc.

LEHMANN DOUBLE BACK-GEARED ENGINE LATHES

Two double back-geared engine lathes of 22- and 24-inch nominal swing, respectively, are now being built by the Lehmann Machine Co., Chouteau Ave. at Grand, St. Louis, Mo. As will be seen from the accompanying illustration, the construction of these machines is similar to that of the geared-head types built by the same concern, which were described in January MACHINERY. On the new machines the headstock is provided with a three-step cone pulley which, through double back-gearing, furnishes nine spindle speeds ranging in geometrical progression. The portion of the headstock casting between the spindle bearings extends to the same height as the axis of the cone pulley so as to prevent the belt from drawing the hand of the operator beneath the pulley.

The spindle is made of an alloy steel, hardened and ground, and has a nose provided with a bearing for faceplates and chucks both behind and in front of the threaded portion. The spindle runs in bronze bearings. The apron has a removable front plate so that its mechanism is accessible without dismounting the entire unit from the carriage, and a central oiling system is provided for the unit, the oil reservoir being located near the top of the apron. Bearings are provided on the apron for the lead-screw and feed-rod so as to prevent sagging and undue wear on the half-nut and the reverse gears. A thread indicator is attached to the carriage for use in cutting threads, this device permitting the carriage to be run back quickly by hand at the completion of a cut and the half-nut to be re-engaged at the correct point. This correct point is determined by reference to the dial on the indicator.

The standard equipment furnished with each lathe consists of a compound rest, a steadyrest, a thread-cutting dial, two faceplates, a double friction clutch countershaft, and wrenches. A taper attachment and follow-rest are furnished extra when ordered. The maximum distance between the centers of machines equipped with 9-foot beds is 4 feet. The weight of the 22-inch lathe with a 9-foot bed is 7500 pounds, while the weight of the 24-inch lathe with the same length of bed is 7800 pounds.



Three-step Cone Double Back-geared Engine Lathe built in 22- and 24-inch Sizes by the Lehmann Machine Co.

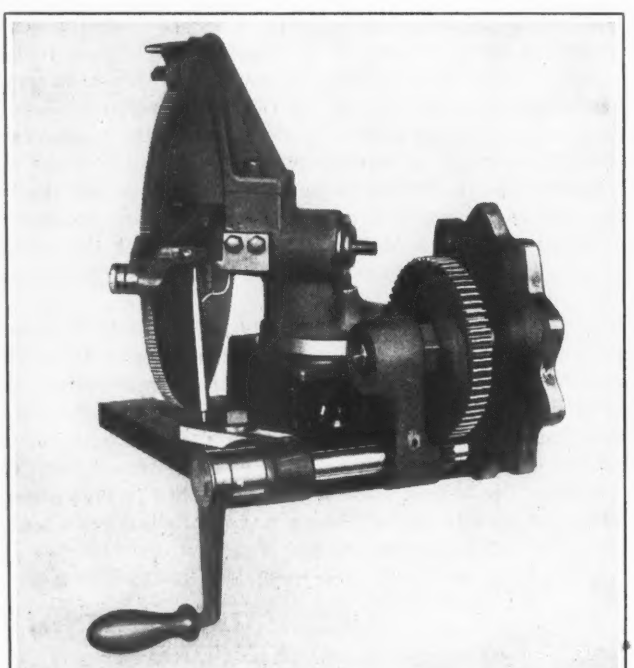
GORTON GRADUATING FIXTURE

In order to graduate, neatly and rapidly, dials, collars and other circular parts up to 4 inches in diameter, the George Gorton Machine Co., Racine, Wis., has developed the fixture shown in the accompanying illustration, which is intended for use in connection with the engraving machines built by the same concern. By means of this fixture graduations may be cut on the flat face of a disk when the lines start at the periphery, on the cylindrical surface of straight collars, and on the beveled faces of such dials as are commonly used on machine tools. The fixture was originally designed for graduating beveled dials 3 inches in diameter and requiring 100 graduations on

one-half the circumference. The actual time for cutting these graduations is about forty seconds.

The indexing of the work is positive, and occurs as the operator turns the crank in a clockwise direction. The turning of the crank also causes the rotation of a small pinion mounted on the opposite end of the same shaft as the crank. This pinion meshes with a gear on a horizontal shaft, directly above the pinion-shaft, to which a ten-point cam is keyed. This cam transmits motion to the work-holder and causes the latter to be moved to and fro in a dovetail slide in the base of the fixture. As the work-holder is moved in and out, the work is traversed past a cutter held in the spindle of the engraving machine. The work-holder can be swiveled through an arc of 90 degrees in order to bring the surfaces to be graduated parallel with the slide. The points on the cam are made to suit the lengths of the graduation lines to be made on the work, and if certain lines are longer than others, the correct graduating is accomplished by having the cam projections of different heights to suit the length of the various lines.

The cutter has a straight shank and is held in a collet that fits a tapered hole in the machine spindle. Any width of line can be produced by grinding the cutter to the proper width and angle. The graduation lines will be uniform in length, depth, and width if the blanks are accurately made. A stop is provided on the indexing wheel to limit the graduations to any predetermined portion of the circumference. This provision insures that the indexing movements will stop exactly at the proper place. The machine spindle is run at a speed of 2000 revolutions per minute when cutting steel parts; from 2000 to 2500 revolutions per minute for cast-iron parts; and 4000 revolutions per minute for brass

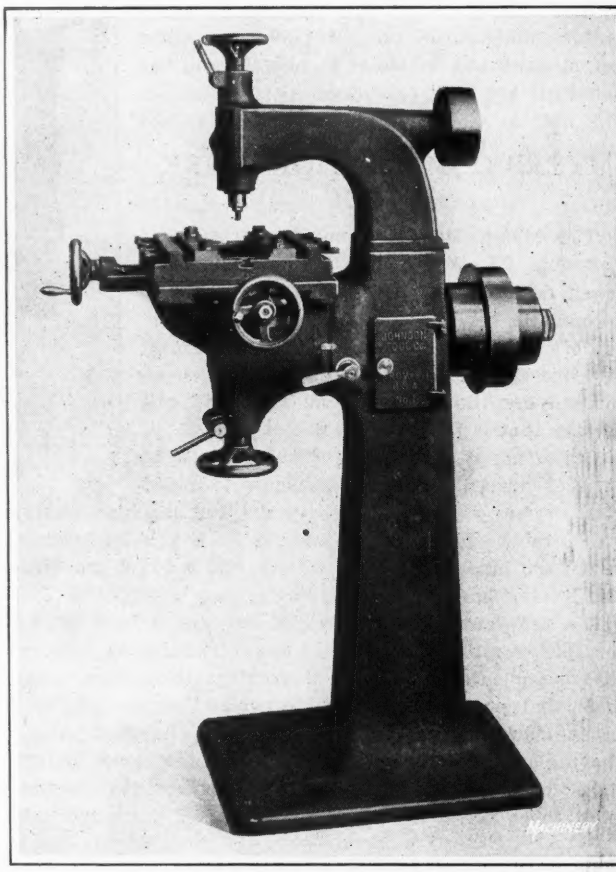


Fixture developed by the George Gorton Machine Co. for Use in graduating Dials and Collars

and bakelite parts. In graduating bakelite dials, the cuts are clean and no burrs are raised, so that additional polishing operations are unnecessary.

JOHNSON DIE MILLING MACHINE

A milling machine designed for the rapid and accurate manufacture of drawing dies and hubs has recently been placed on the market by the Johnson Tool Co., 201 Eddy St., Providence, R. I. This machine has two spindles, one of which is carried under the vise table and the other in a swinging head mounted on top of the column. When the machine is to be used on a job for which the upper spindle is not required, this head may be swung at right angles to the position shown in the illustration. Taper bearings are provided for both spindles, so that wear may be taken up. By means of a clutch arrangement which is located inside the cone pulley, the lower spindle can be made inoperative while the upper spindle is being used.



Die Milling Machine manufactured by the Johnson Tool Co.

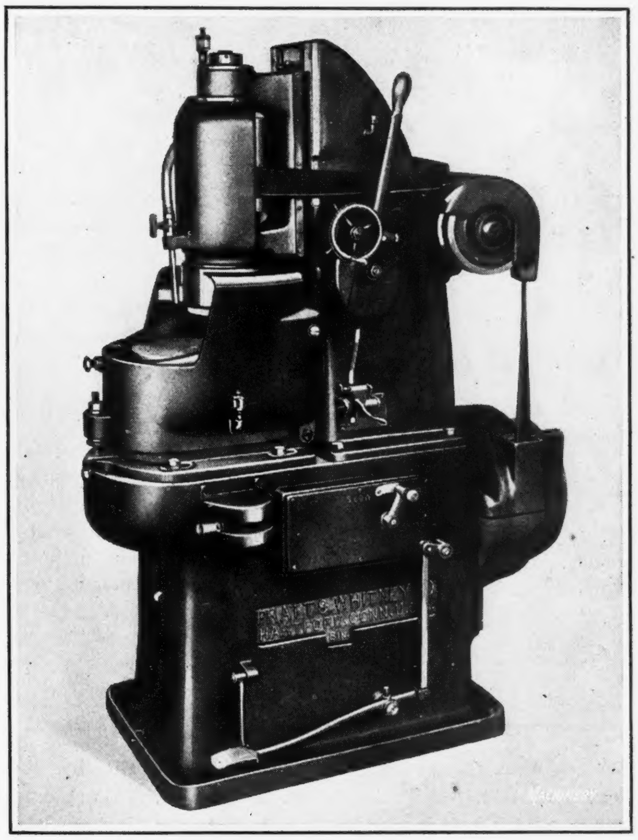
The machine is also equipped with a tilting table which enables the operator to obtain a good view of the work in progress. Special adjustments are furnished for taking up the wear on both cross and longitudinal screws. A patented pull-type countershaft is supplied with the machine. The tilting table has a capacity of 9 inches when not fitted with jaws; when jaws are provided, the capacity is $5\frac{1}{2}$ inches. Some of the other principal specifications are as follows: Cross-feed of the table, 4 inches; lateral feed, 6 inches; weight of machine, 600 pounds; and floor space occupied, 29 by 40 inches.

PRATT & WHITNEY ROTARY SURFACE GRINDING MACHINE

A machine designed principally for the grinding of disks, rings, and cylinders requiring flat and parallel surfaces, such as gear blanks, washers, cutter hubs, and sprockets is shown in the accompanying illustration. This machine is an 8-inch rotary surface grinder, and is a recent product of the Pratt & Whitney Co., Hartford, Conn. The spindle is mounted on ball bearings, amply lubricated, protected from dirt, and provided with adjustments for wear. The grinding wheel is cemented in a holder screwed to the spindle, and thus the changing of wheels is a simple proposition. A band clamped around the wheel guards it from breakage, and an adjustable steel guard automatically covers the entire wheel. The feed of the wheel is controlled by a lever, and a positive stop is provided to facilitate grinding work to a specified thickness. Fine adjustments are made through a handwheel which can be locked and used as a

feed-wheel when desired. The wheel-slide is overweighted in order to obtain an easy control.

The machine is equipped with a rotary magnetic chuck having two speeds, which can be tilted to enable the grinding of concave or convex surfaces. The chuck is controlled by a foot-pedal, and a connecting brake retards the rotation in stopping. A pump and tank are furnished for supplying lubricant to the inside and outside of the wheel, the flow being regulated by valves. The shut-off valve is ordinarily



Eight-inch Rotary Surface Grinding Machine built by the Pratt & Whitney Co.

controlled by the feed-lever, but it can be disconnected and operated by a pull-knob. The spray is confined by a guard, the front of which can be lowered to facilitate the handling of work. The main driving shaft and idler pulleys are mounted on ball bearings, while the clutch is mounted on a thrust bearing. A belt drive is regularly furnished with the machine.

Some of the principal specifications of the machine are as follows: Maximum distance from top of chuck to face of new wheel, 5 inches; diameter of chuck, 10 inches; maximum amount chuck can be tilted for concave or convex grinding, 2 degrees; diameter of grinding wheel, 8 inches; speed of grinding wheel, 2000 revolutions per minute; speed of chuck, 50 and 100 revolutions per minute; and weight of machine, 3000 pounds. The regular equipment furnished with the machine includes two wheel mounts, one grinding wheel, one wheel dresser, a countershaft and wrenches. When motor drive is desired, a 7½-horsepower constant-speed motor, running at 1800 revolutions per minute, is furnished.

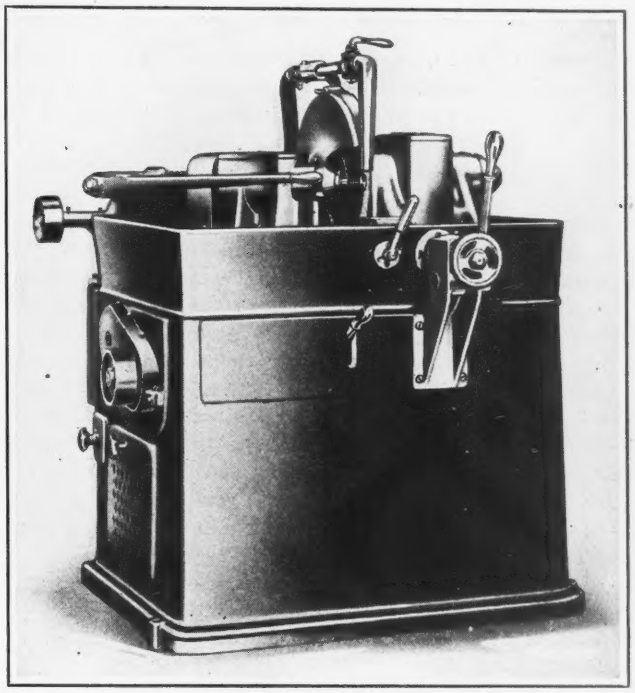
GENERAL ELECTRIC HEATING UNIT

A sheath wire unit for electric heating applications has been perfected by the General Electric Co., Schenectady, N. Y. The new unit is known as the "helical coil" sheath wire unit, and is an improvement over the drawn sheath wire unit which this company has manufactured for several years. The unit consists of a heating element in the form of a helical coil of wire that is held firmly in place in a metal tube by a filler of powdered insulating material. The sheath is made of different metals or coils, depending upon the use for which the unit is intended.

Three special forms of the unit have been developed. The first is an air-heating unit, and is intended for heating small storage rooms, exposed valve houses, crane cages, etc. The second style is particularly adapted for warming glue troughs, flat plates on machines, etc. The third type is an immersion heater, of which there are several forms. These are intended for heating water or oil in kettles, tanks, etc., and for oil tempering baths. They are entirely immersed, so that all the heat generated by the unit is absorbed by the liquid. The units are regularly made 0.333, 0.4, or 0.496 inch in diameter, the lengths being up to 6 feet for the smallest diameter unit and up to 8 feet for the largest.

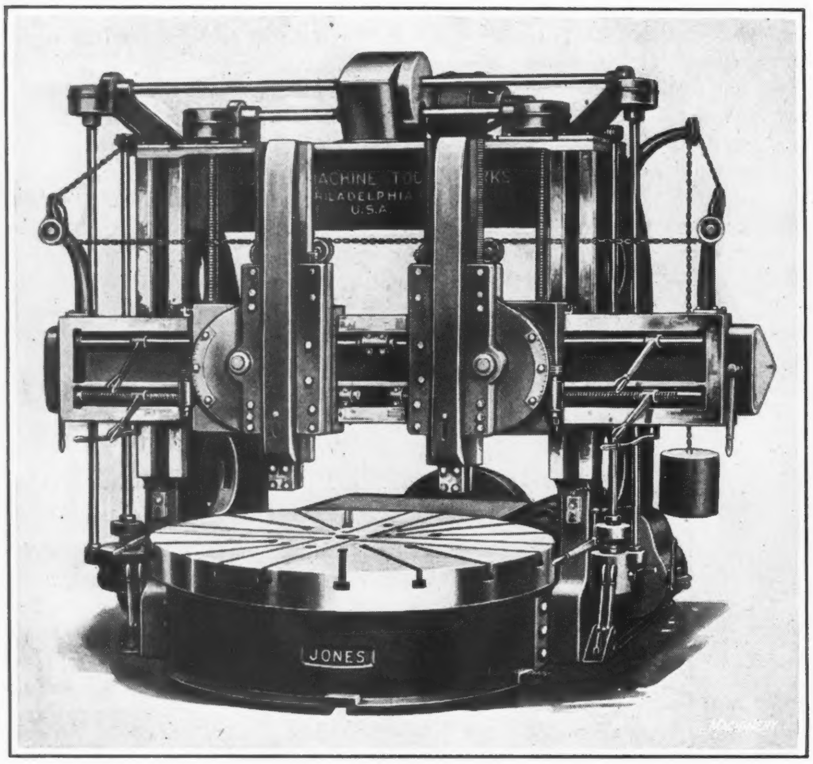
FITCHBURG POPPET VALVE GRINDING MACHINE

The Fitchburg Grinding Machine Co., 76 Winter St., Fitchburg, Mass., has recently placed on the market a machine arranged for grinding the seating surface of gas-engine poppet valves, as shown in the accompanying illustration. During the operation, the valves are held in a collet chuck, although the machine may also be arranged for grinding valves held between centers. The collet chuck is operated by a lever on one side of the work-head. The work-head can be set at any angle to suit the valves being ground, and it has an automatic movement parallel to the wheel-spindle, which can be varied to meet different conditions.



Machine built by the Fitchburg Grinding Machine Co. for grinding the Seating Surface of Poppet Valves

The wheel-head has a cross-movement, and is operated by a vertical lever directly in front of it. A handwheel having a micrometer reading enables accurate compensation to be made for wear of the wheel. The lever to the left of the handwheel is used for operating a diamond truing tool, and the lower lever to the left of the handwheel is employed for starting and stopping the work-head. The machine is driven by a three-horsepower motor located in the base, and the weight of the machine, including the motor, is approximately 2500 pounds. The general construction of this machine is such that it can also be arranged for grinding a variety of small parts in plants where a large production is required, thus permitting the machine to be kept busy on one particular part.



Vertical Boring and Turning Mill built by the Jones Machine Tool Works

JONES VERTICAL BORING AND TURNING MILL

A vertical boring and turning mill designed for rapid production and simple operation has been recently brought out by the Jones Machine Tool Works, Philadelphia, Pa. The push-buttons for starting and stopping the motor, and the control levers, are located on each side of the machine for the convenience of the operator. The machine may be driven either by a constant- or a variable-speed motor; the constant-speed motor supplies sixteen speeds through a speed-change box. The drive from the motor to the large ring gear bolted to the under side of the table is through sliding speed-change gears, miter gears, and a pinion.

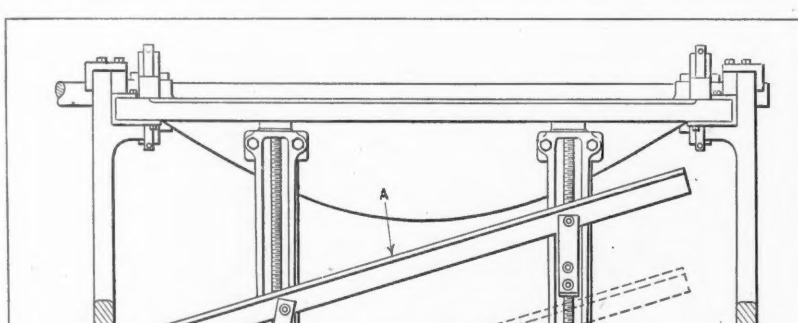
The table runs in a constantly lubricated annular V-shaped bearing of large diameter. The table spindle is supported in vertical bronze bearings situated in the main base, the top bearing being cone-shaped and provided with means of compensating for wear. The lower bearing is straight and supports a step bearing composed of alternating bronze and steel washers that run in oil and are used for raising the table from the annular bearing when machining light work at high speeds. T-slots are provided for bolting down work and accommodating chucks or special fixtures. The cross-rail is of the three-track type; it has the saddle screws located between the two lower tracks, and the worm-shafts for operating the boring-bars between the upper tracks. The cross-rail clamps to the inner and outer guides of the housings, and is raised and lowered through screws and nuts. A motor located on the bridge which ties the housings together at the top furnishes the power for this mechanism.

The saddles are fitted with clamps, tapered gibs, and a clamping screw for locking them to the cross-rail when the boring-bar is being fed. The saddles are operated by a hand ratchet feed in making fine adjustments, and they are also provided with power feed and quick traverse. The boring-bars are fitted in saddle members which can be swiveled 30 degrees on either side of the vertical position by using a ratchet wrench, which, through a worm, drives a worm-gear segment on the saddle member. The face of this segment is graduated in degrees to indicate the angle at which the slide is set. The bars can also be operated by a hand ratchet feed or by a power feed or quick traverse. They are counterbalanced by weights located at the rear of the housings, and are equipped with clamping screws for locking them in place when the saddles are being fed. The tool-holders are made from steel forgings and have tapered shanks.

No friction clutches are employed in the speed-change box unless the machine is driven by belt, in which case the driving pulley is of the friction clutch type. Speed changes are obtained by operating levers on each side of the machine. The feeds for the saddles and boring-bars are independent for each side of the machine. Safety friction clutches are supplied to prevent breakages that would be likely to occur if a saddle or bar should become jammed. The quick-traverse driving shafts receive their power from the motor on the bridge, and the operating levers for these shafts are located at each end of the cross-rail. This machine is made in the following sizes: 60, 72, 84, 100, 120, and 144 inches. The weight of the smallest size is 25,000 pounds, and that of the largest, 96,000 pounds.

NIAGARA SHEAR GAGE

The power sheet-metal squaring shears built by the Niagara Machine & Tool Works, Buffalo, N. Y., are now being equipped with a patented gage which may be accurately adjusted to govern the length of the sheet being cut or the angle at which it is severed relative to the face of the shear blades. This gage is shown diagrammatically in the accompanying illustration, with the gage-bar *A* placed at an angle to the shear blades. When the attachment is on a machine, one leg of the bar projects beneath the upper blade, so that sheets inserted between the blades may be pushed against this leg. The distance of the bar from the shear blades is set by adjusting screws, which may be rotated in unison or independently of one another. The rotation of the screws in unison is accomplished by turn-



Diagrammatic Illustration of Adjustable Gage furnished on Shears built by the Niagara Machine & Tool Works

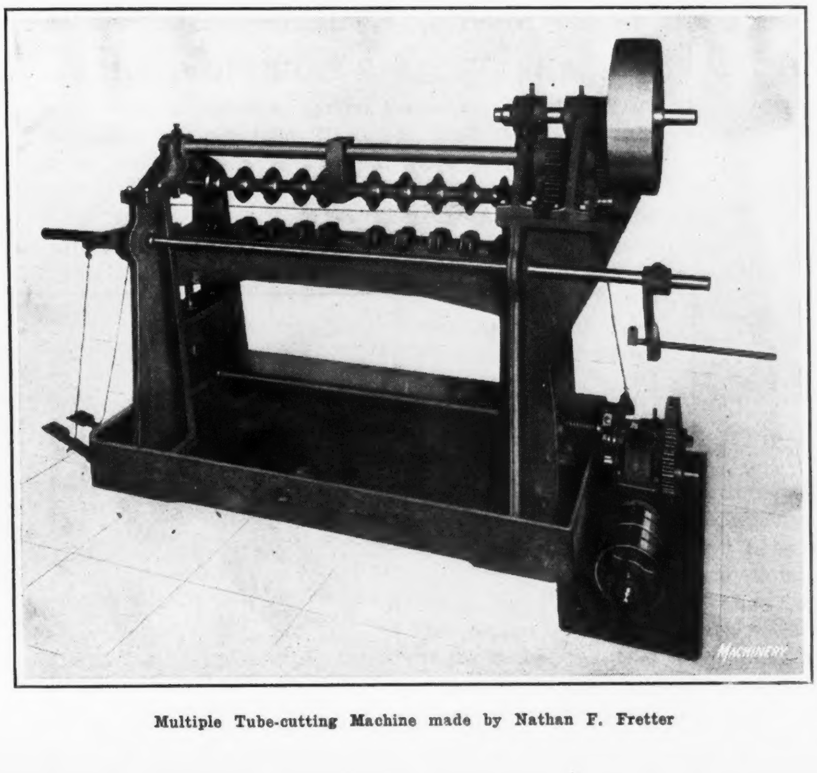
ing either of handwheels *B* when the nut of a clamping bolt on coupling *C* has been tightened. By loosening this nut, the adjusting screws may be rotated independently.

Each of the handwheels *B* has sixteen holes equally and accurately spaced about a circle on its web, and a locking pin is provided to engage these holes. Thus, as the adjusting screws have four threads per inch, the adjustment of the sliding block on each screw, which is connected to one end of the gage-block, may be governed within 1/64 inch. In assembling the parts the sliding blocks are located in approximately the correct positions through the use of measuring scales mounted on the sides of the arms which support the device. Each inch on these scales is divided into four parts to equal the lead of the adjusting screws, and so one complete revolution of a handwheel changes the position of the sliding blocks a distance corresponding to one division on the measuring scales. This gage is also made in a style which does not have the provision for rotating the two adjusting screws simultaneously.

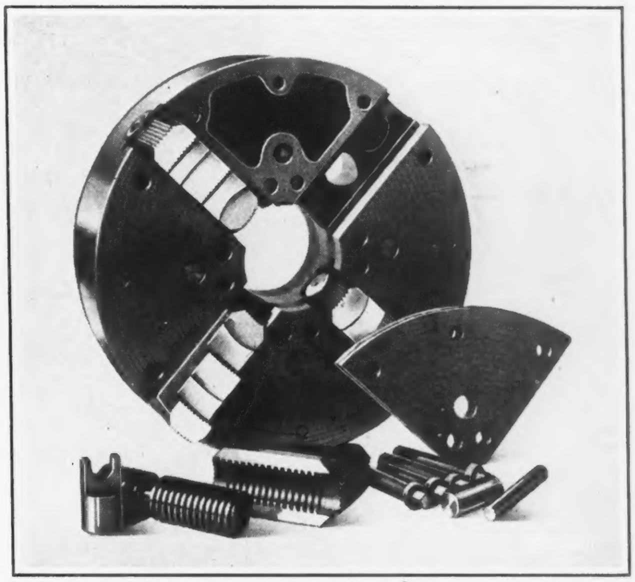
FRETTER TUBE-CUTTING MACHINE

The accompanying illustration shows a machine which cuts a pipe or tube into a number of pieces in one operation by bringing the stock into contact with rotary cutters. This machine is built by Nathan F. Fretter, 9113 Columbia Ave., Cleveland, Ohio. The cutters are mounted adjustably on a horizontal shaft, which is driven through back-gearing and a pulley, and they can be readily removed from the shaft for replacement. The cutters are sharpened while they rotate on the machine by employing an electric grinder.

There is a dovetail groove in the table in which are placed a number of tube-rests, which may be positioned to correspond with the cutters. The table height is adjusted to suit the diameter of the tube and wear of cutters, by turning a crank at the front of the machine. The table is raised by means of cams mounted on the shaft at the bottom of the machine, this shaft being rotated one revolution through a clutch operated by a foot-treadle. In operating the machine, the attendant places a long tube on the machine table, and then operates a treadle which controls the work-stop and, finally, the treadle that operates the clutch. The cut pieces of a tube are pushed off the machine when a new piece of tubing is inserted. The machine has a capacity for cutting tubes having an outside diameter of 2½ inches and a wall thickness of 3/16 inch.



Multiple Tube-cutting Machine made by Nathan F. Fretter



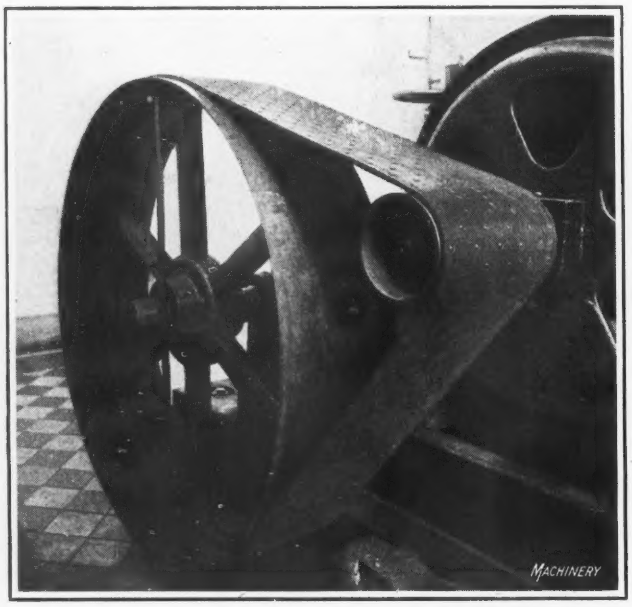
Coventry Four-jaw Independent Chuck made by Alfred Herbert, Ltd.

ALFRED HERBERT FOUR-JAWED INDEPENDENT CHUCKS

A line of Coventry four-jaw independent chucks designed to withstand, without breakage, the severe usage generally accorded such accessories is now being sold by Alfred Herbert, Ltd., 50 Church St., New York City. One of these chucks is shown in the accompanying illustration with some of the details disassembled in order that an idea may be obtained of their ruggedness. It will be noted that the jaws and screws are retained in the chuck by means of detachable sector plates. These plates are attached to the chuck body by bolts inserted from the back of the chuck. The chuck body is made sufficiently thick to withstand abuses which might cause this member to become fractured where it is machined to accommodate the jaws. The jaw screws are made of chrome-nickel steel and of large proportions, and the jaws are hardened all over. Ample metal is furnished around the square wrench holes in the ends of the screws. The thrust blocks for the screws are also made of chrome-nickel steel and heat-treated. All parts of the chuck may be replaced if this should prove necessary. On the lathes manufactured by the same concern, the chuck is attached directly to a spindle flange by studs and nuts, but adapters must be employed when the spindles are not flanged, and these adapters should be turned up in position on the spindles of the lathes on which the chucks are to be mounted, before the chucks are attached.

PIEUVRE BELTING

An installation of a special belt sold under the trade name of "Pieuvre" by J. L. de Rabot, 191 Greenwich St., New York City, is here illustrated. This belt consists of a length of oak-tanned leather belting, to the inner surface of which are attached narrow longitudinal strips of chrome-tanned leather. The oak-tanned leather is used to give the necessary strength to the belt, and the purpose of the chrome-tanned leather is to increase the adhesive qualities. The chrome-leather strips are held in position by means of hollow brass rivets, which are clenched well home on the under side so that a small pocket is formed around each rivet. These pockets, combined with the blind holes in the rivets, create a suction

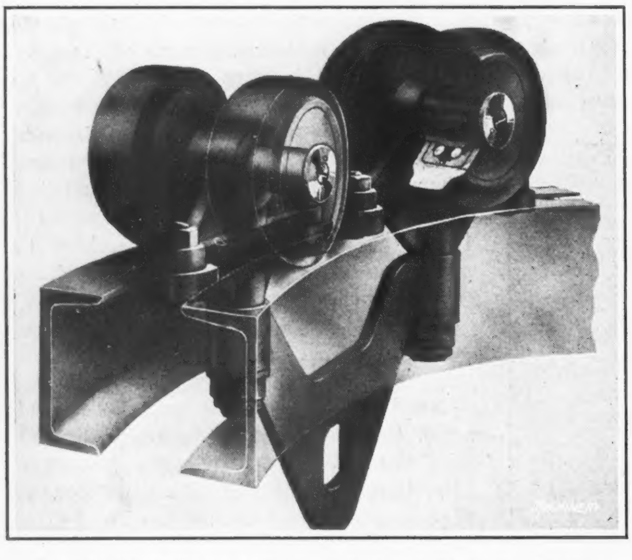


An Installation of Pieuvre Belting which is sold by J. L. de Rabot

when the belt passes around the pulley, and so augment the adherence of the belt. In some cases, narrow grooves are cut between the strips, to increase the crosswise flexibility of the belt and allow it to mold itself more completely to the shape of the pulleys. It is stated that no compound is required to obtain satisfactory friction between this belting and a pulley, because the coefficient of friction is exceptionally high, and even though the center distance between the pulleys is very short, idler pulleys are not required.

WHITING SHORT-TURN TROLLEY SYSTEM

An overhead trolley system in which the curvature of the switches and corners is only 18 inches, so that it is especially adapted for serving a row of machines placed close



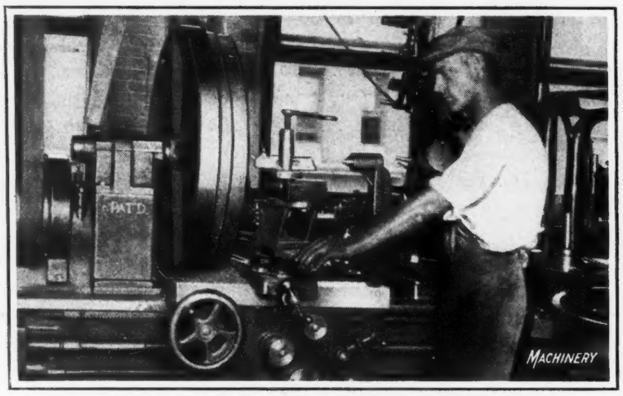
Four-wheeled Trolley and Track of System built by the Whiting Corporation

to a wall, is being marketed by the Whiting Corporation, Harvey, Ill. The track consists of two standard rolled channel irons, spaced 2⅛ inches between the flanges and held in place by clamps. It does not have any intermediate supports except at the splices, corners, and switches; and another special feature of the system is that long spans, such as from one building to another, can be made without any intermediate supports by simply using a heavier section of channel.

Each corner and switch connection is interchangeable, so that at any time a double or universal switch may be substituted for a corner. The track is built in single units and can be erected as such. Two-, four-, and eight-wheeled trolleys can be supplied, a four-wheeled trolley being shown in the illustration. These trolleys have ball-bearing wheels and guide rollers. The latter run between the toes of the channel irons, and eliminate friction by making it impossible for the wheels to bind against the track when rounding curves. The trolleys run on the top of the channel tracks as shown. This trolley system can be readily wired, when it is desired to use an electric hoist in place of a chain block. Switches of 90 or 45 degrees, or of the universal style can be supplied.

LATHE ATTACHMENTS

A lathe equipped with attachments made by the Star Machine & Tool Co., 433 Champlain Ave., Cleveland, Ohio, to double the capacity of such machines, is here illustrated. One attachment is a special headstock which has a faceplate spindle mounted directly above the regular spindle. The top spindle is connected to the lower one through gearing.

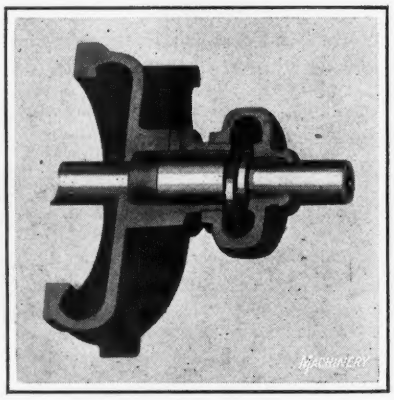


Lathe equipped with Capacity-increasing Attachments made by the Star Machine & Tool Co.

The two other attachments provided are for raising the toolpost and tailstock center to suit the height of the faceplate. These attachments may be set up on a machine in less than ten minutes, and are especially useful in toolrooms and garages on jobs necessitating a greater swing than can be obtained on the lathes available.

ARROW PUMP PACKING GLAND

Centrifugal and rotary pumps built by the Arrow Pump Co., Room 54, Buhl Bldg., Detroit, Mich., are now being equipped with the type of packing gland here illustrated, this gland being also applicable to many other devices or machines on which a rotating shaft requires packing. The ring-oiling principle of lubrication is incorporated in the design of this packing gland, this provision permitting a constant supply of oil to the gland so that it is practicable to use the latter also as a bearing. This arrangement permits the shaft to be supported close to the load. With this method of lubrication there is always a film of oil between the packing and a rotating shaft, thus reducing wear of the parts.

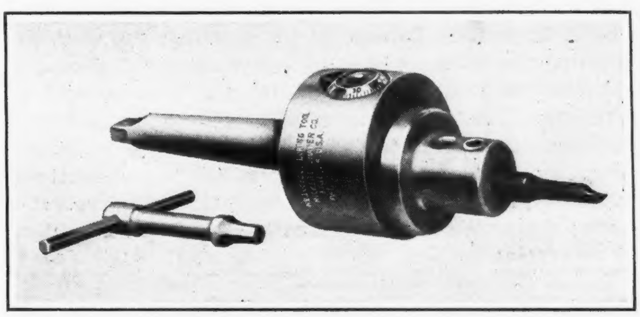


Packing Gland supplied in the Pumps built by the Arrow Pump Co.

RICKERT-SHAFER ADJUSTABLE BORING HEAD

An adjustable boring head adapted to various machine tools for use in drilling, boring, and turning operations is shown in the accompanying illustration. This tool has just been placed on the market by the Rickert-Shafer Co., 612 W. 12th St., Erie, Pa., and is especially recommended for work where accuracy and high speed of operation are desired. Accuracy of the tool is obtained through a cross-screw machined within a tolerance of 0.0005 inch. This screw is provided with a friction dial graduated in thousandths of an inch, which eliminates the necessity of employing cut-and-try methods in using the tool. Moreover, with this provision it is unnecessary for a person to remember previous settings, as the dial can be rèset to zero as required.

When the boring tool has been adjusted and locked in position, the tool is said to be practically as rigid as a solid tool. This result is obtained by a clamping means which, besides locating the tool-holder in the desired position, also pulls and holds the tool-holder rigidly against the



Adjustable Boring Head manufactured by the Rickert-Shafer Co.

head and shank. The clamp is actuated by a safety setscrew that works at right angles to the adjusting screw. The boring head is made in three sizes, the diameter of the hole for the tool in the different sizes being ½, ¾, and 1 inch, respectively.

McCROSKY FLOATING HOLDERS

Parallel and angular misalignments of the tool in reaming, tapping, and similar operations may be avoided by the use of the holder shown in Fig. 1, which belongs to a line of floating holders being placed on the market by the McCrosky Tool Corporation, Meadville, Pa. These holders are intended for application on various types of machine tools, and may be supplied for either vertical or horizontal use. Each holder consists of three principal units—a driving member, an intermediate floating member, and a driven member.

As will be seen by reference to Fig. 2, in which a holder is shown disassembled, the shank or driving member is provided with a piece having two lugs that interlock with

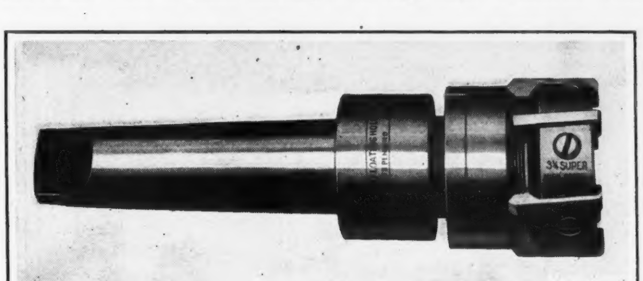


Fig. 1. Floating Holder made by the McCrosky Tool Corporation

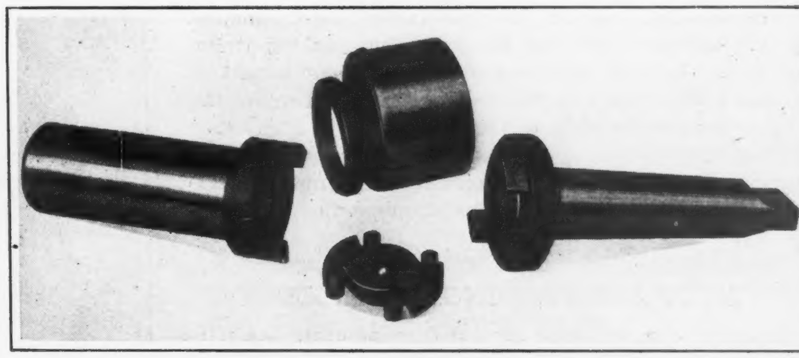
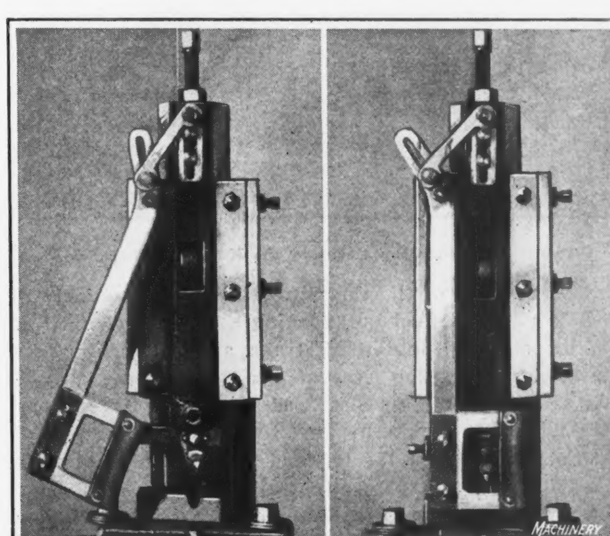


Fig. 2. Parts of the McCrosky Floating Holder

two similar lugs on the driven member. Four hardened rollers are placed between these lugs and the intermediate floating member in order to eliminate friction resulting from the driving action. A hole is provided at the center of the floating member, and a hardened steel ball is placed in this hole. The diameter of the ball is greater than the thickness of the floating member, and therefore it projects beyond the sides of the latter and bears against both the driving and driven members. In this way, it takes the entire thrust of the cut and acts as a pivot to allow free angular movement. One end of the housing which encloses the floating unit screws on the threaded part on the shank. A collar is screwed into the opposite end of the housing and this collar bears against the driven member. By adjusting the collar the amount of float may be regulated. When the holder is used horizontally, an adjustable spring support, which bears against the driven member, is added to counteract the weight of the tool shank in the holder.

The driven member of the holder is made in three styles. One style may be bored to accommodate a shank of any diameter within certain limits; the second is provided with a Morse taper socket; and the third has a shell reamer arbor. The holders may also be furnished with either straight or taper shanks. The smallest holder of each style has a capacity for reamers up to 1½ inches in diameter, while the largest size is suitable for reamers up to 6 inches.



Foot-press Safety Guard made by Woodward & Wolf

WOODWARD & WOLF PRESS GUARD

A guard for preventing injury to operators of foot presses has been placed on the market by Woodward & Wolf, 213 Rosemont Ave., Trenton, N. J. This guard is shown at the left in the accompanying illustration in its position at the beginning of a downward stroke. It will be seen that it is well out of the way so as not to interfere with the placing or removal of work in the press die. When the ram begins its downward stroke, the guard swings well across the

danger spot, as shown at the right in the illustration, in only a ⅜-inch movement of the ram, thus making it impossible for the most careless operator to become caught as the punch descends. At the end of the ram stroke, the guard extends to the right of the punch in such a way that it is impossible for an operator to work around or in back of the guard. This guard can be changed in a few minutes' time to suit either right- or left-hand operators.

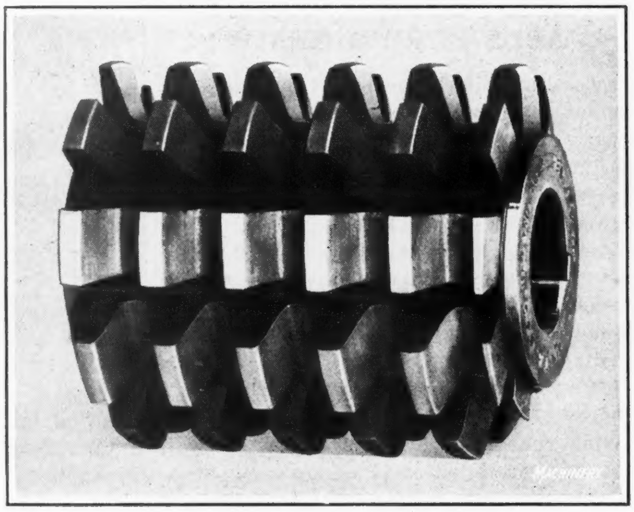
MILWAUKEE 9-INCH SHAPER

A 9-inch shaper, designed for handling accurate work in the tool-room as well as for use in the quantity production of small parts which must be shaped quickly and economically, is now being manufactured by the Milwaukee Shaper Co., 1023-1029 Cold Spring Ave., Milwaukee, Wis. The ram has wide bearings and is scraped to an accurate fit with the ram gib so as to assure smooth operation without vibration. Adjustments can be made to compensate for

Nine-inch Tool-room Shaper built by the Milwaukee Shaper Co.

wear. The length of the ram stroke is changed quickly by releasing a friction lock-nut, turning a handwheel until an indicator points to the desired stroke, and then again tightening the lock-nut. The cross-rail has wide bearing surfaces which are accurately scraped, and the saddle is provided with a taper gib to take up any wear of the cross-rail. T-slots are furnished on the top and sides of the table, and the latter can be tilted to either side.

A screw inserted in a graduated rocker-arm attached to a handwheel regulates the feed, and a connecting-rod which slides in a steel tube permits raising and lowering of the cross-rail. The tool-head is graduated; it can be swiveled through an arc of 60 degrees, and is provided with a micrometer adjustment. The swivel vise has a graduated base, steel jaws, and is supplied with an extra set of jaws for the accommodation of tapered work. Some of the principal specifications of this shaper are as follows: Size of table top, 8¾ by 8½ inches; automatic cross-traverse, 11 inches; vertical adjustment of table, 8 inches; down feed of tool-head, 4 inches; cutting speeds of ram, 4; keyseating capacity, 2 inches; maximum opening of swivel vise jaws, 6 inches; and net weight, 800 pounds.



Gear Hob manufactured by the Simmons Method-Hob Co.

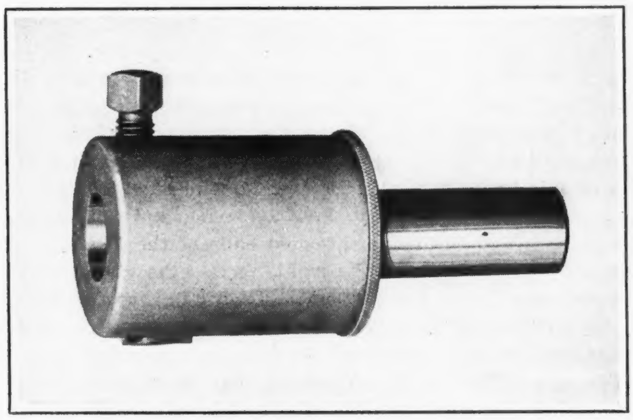
SIMMONS-METHOD GEAR HOBS

The Simmons Method-Hob Co.. 2nd St. and Duncannon Ave., Olney, Philadelphia, Pa., is now manufacturing gear hobs that have the teeth generated on special machines by a process known as the Simmons method. One of the hobs is here illustrated. Because of the fact that the teeth are generated, the hobs produced by this method can always be duplicated with precision. In cutting a large number of gears of one kind, the hobs, of course, wear out, and so a means of duplicating the worn-out hob should be appreciated. In the Simmons method each hob is a duplicate of another, because every hob is an original master generated on the same or a similar machine by the identical mechanical movement.

UNION ZINC-COVERED TOOL CHESTS

Electricians, mechanics, plumbers, etc., will be interested in a line of zinc-covered tool chests which is now being manufactured by the Union Tool Chest Co., 83 Mill St., Rochester, N. Y. These new chests are provided with a tray that automatically raises with the top and in doing so, remains level and out of the way. However, the chests can be furnished without trays if desired. The covering is of lacquered zinc, carefully formed over at the edges and securely attached, and will not corrode. All corners, catches, clamps, and locks are either brass plates or lacquered steel, and are securely riveted in place. The chests are furnished with a leather handle and a special Corbin lock.

Zinc-covered Tool Chest made by the Union Tool Chest Co.



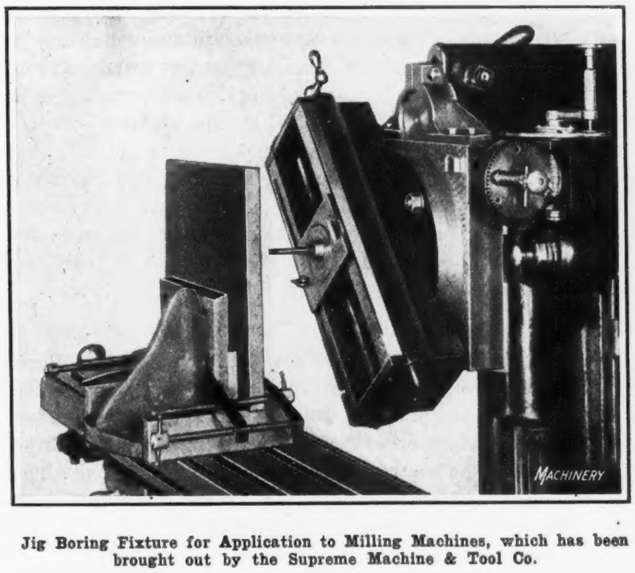
Releasing Tap- and Die-holder made by the Warner & Swasey Co.

WARNER & SWASEY RELEASING TAP- AND DIE-HOLDER

The Warner & Swasey Co. Cleveland, Ohio, has developed an improved type of releasing tap- and die-holder which, while consisting of only eight pieces, has incorporated in it all the features of the older twenty-three-piece style. The new holder is shown in the accompanying illustration. It is suitable for either right- or left-hand taps or dies. In changing the holder to accommodate a different hand tool, a small tightening screw is first loosened by means of a screwdriver, and then a pawl is turned half way around in its hole. A small pin secures the pawl in position. In threading a part, this pawl holds the tool rigid until the turret stop is reached. Then the head moves forward on the work and pulls a cam over the pawl, which releases the head and allows it to revolve freely. A spring cushions the pawl so that the releasing action is without jar and practically noiseless. The holder can be readily cleaned and oiled, and by reason of its adaptability for right- and left-hand tools, it reduces the number of tap- and die-holders required in a shop.

MILLING MACHINE FIXTURE

To eliminate the slow and costly practice of figuring and checking angles or using buttons for locating purposes when boring accurately spaced holes in a jig member the Supreme Machine & Tool Co., 1738 St. Clair Ave., Cleveland, Ohio, has developed the milling machine fixture illustrated. By means of this fixture it is unnecessary to shift the work after it has been set up on the table of the machine, the boring tool being moved as required. The fixture is arranged for fastening on the column and over-arm of any milling machine, the base being designed to suit the particular machine on which the fixture is to be attached.



Jig Boring Fixture for Application to Milling Machines, which has been brought out by the Supreme Machine & Tool Co.

A gear fitted to the spindle of the milling machine drives the fixture spindle through bevel and spiral gears. The fixture spindle can be moved radially in a slide which can be accurately adjusted through the use of the vernier scale with which it is furnished. The member that supports the slide has a circular movement obtained through two worms and gears, and is graduated to allow settings to be made in seconds. In using the fixture, the work is clamped on the milling machine table, the starting hole is located relative to the fixture spindle, and the knee and table are clamped in place. All movements from this point are made with the fixture, and thus one of the greatest sources of error in work of this kind is avoided. The illustration shows the fixture mounted on a Brown & Sharpe universal milling machine.

A chart furnished with the fixture gives the exact movements of the indexing gears necessary to set the boring head at the required angle. This information is presented in such a way that there is no chance for an operator to misread the directions. The spindle is provided with tapered bearings that are adjustable for wear, and provision is also made to prevent backlash of the indexing worms. Besides work of the class mentioned, the fixture will handle other work of circular or irregular shape, and thus is particularly suitable for the machining of cams.

NEW MACHINERY AND TOOLS NOTES

Portable Electric Drill: Louisville Electric Mfg. Co., Louisville, Ky. A No. 3, two-speed universal drill which operates on either direct or alternating current. The speed changes are obtained by shifting a small knob located close to the handle, while another knob on the handle controls the switch for operating the motor. A Jacobs chuck is included in the standard equipment. The drill has a capacity for drilling 1/2-inch holes at high speeds, and 5/8-inch holes at low speeds.

Shaft Coupling: Kay Mfg. Co., South Norwalk, Conn. A free-floating shaft coupling which compensates for both parallel and angular misalignment of connected shafts, as well as providing for axial movement, such as the floating of an armature shaft. Power is transmitted from the driving to the driven hub through a floating link. A casing surrounds the parts, retaining rings preventing the hubs from slipping out. The coupling is made in sizes to fit shafts from 7/8 to 6 1/2 inches in diameter.

Drill Chuck: Karge-Baker Corporation, Phoenix, N. Y. A chuck provided with a cushioning feature which permits a moderate relative rotation between the shank and the socket ends. A helical spring transmits the driving torque from one end of the chuck to the other, thus absorbing shocks and eliminating chatter. The chuck is made in five sizes to carry drills from 1/4 inch to 4 inches in diameter, taps from 1/4 inch to 7 inches in diameter, and die-heads from 3/4 inch to 9 inches in diameter.

Filing Machine: Boston Tool & Mfg. Co., 262 Dover St., Boston, Mass. A bench filing machine having a reciprocating movement for using ordinary files in the regular manner, or a rotary motion for round files or special milling cutters. The table may be tilted to any desired angle for the purpose of giving draft to dies or similar pieces. The machine is driven through a three-step cone pulley. Special files having inverted teeth can be supplied so that the pressure on the work will always be downward.

Quick-change Lathe: Rockford Lathe & Drill Co., Rockford, Ill. A 12-inch single back-geared quick-change engine lathe having a spindle with a 1 1/16-inch hole which permits the use of draw-in collets up to 5/8 inch in capacity. The carriage is provided with a thread indicator which permits the proper engagement on a thread being cut without reversing the lathe. A quick-change gear-box furnishes thirty-two changes of feed. Threads of special pitch may be cut by substituting suitable gears on the quadrant.

Ring and Circle Shear: Niagara Machine & Tool Works, Buffalo, N. Y. A No. 13-B deep-throat ring and circle shear, intended for work on light material. The machine cuts not only outside circles, but also holes and reverse curves. The upper cutter can be raised and lowered to penetrate the stock, so that the cut can be started in any part of the sheet

and not only on an edge. The machine has a capacity for cutting up to No. 20 gage soft steel, and the distance from the throat of the cutting head to the frame is 18 inches.

Tool-holder: Rapid Universal Tool-holder Corporation, 199 Franklin St., New York City. A tool-holder intended for general use in a lathe, boring mill, or shaper. A square hole is broached through the front end of the shank to suit the holding of square-section tool bits. Round, square, or hexagonal bars can be held to the shank transversely, and small bars can be secured in place by means of a V-block. It is thus possible to hold boring tools, drills, taps, etc., up to ¾ inch in diameter. A special clamping device is provided for holding a parting or cutting-off tool.

Movable Side-rail Planer: Betts Machine Co., 400 Blossom Road, Rochester, N. Y. A 13-foot planer with the left-hand side-head mounted on a vertical rail that can be moved relative to the table, the advantage being that work of different widths can be accommodated without any undue overhanging of either side-head. The center of the table is offset from the center of the machine. The movable member on which one of the side-heads is mounted has a bearing at the top on the cross-rail and at the bottom on the foot of the upright, and moves up and down with the cross-rail. Two heads are also provided on the cross-rail, and all four heads are equipped with patented feed and power rapid traverse mechanisms.

Couplings for Shafts, Pulleys, Gears, and Clutches: Karge-Baker Corporation, Phoenix, N. Y. A flexible "cushion" coupling made in a variety of forms to adapt it for various uses. The coupling, when used for connecting rotating shafts,

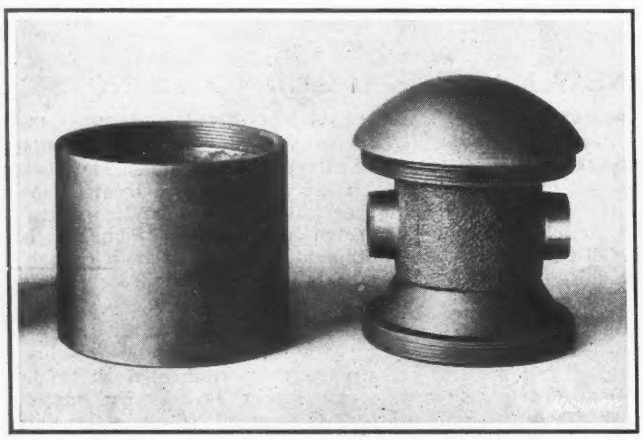


Fig. 1. Shell and Center of Ringless Piston

corrects parallel and angular misalignment and permits armature float. A helical steel spring of square section is used for transmitting the drive between the two members of the coupling, and this arrangement provides for the absorption of shocks. The coupling is also made with a bushing on which a pulley can be mounted, one end of the coupling being connected to the shaft, and the other end to the pulley bushing. A pulley of this type is especially applicable to motors for absorbing shocks produced in starting. Similar devices are made to do away with shocks in gear trains and in friction-clutch drives.

Bevel Gear Planer: Gleason Works, Rochester, N. Y. A 37-inch two-tool bevel gear planer designed for cutting large diameter and coarse pitch bevel gears. It has a capacity for cutting gears of a pitch cone radius up to 26 inches. A 37-inch diameter miter gear has a pitch cone radius of approximately this dimension. A pivoted work-head and a column which carries the tool-heads are mounted on the bed of the machine. The column is stationary and also carries the driving pulley, the tool speed-change box and the crank plate drive. Two hinged arms on the face of the column are free to open and close vertically about the center of the machine, this center being the apex of the cone of a gear being cut. Each arm carries reciprocating slides on which the tools are mounted, and the stroke movements of the slides are effected through a rack and pinion. The tool-slides are so constructed that gears can be cut from the center outward, as well as from the outside toward the center.

* * *

Wages in the machine shop industries in Belgium vary from 2.45 to 2.60 francs (about 18 to 20 cents, present exchange) an hour. In foundries the wages for skilled molders are somewhat higher—3 francs (about 23 cents) an hour.

RINGLESS PISTONS FOR AUTOMOBILE ENGINES

A novel ringless type of automobile engine piston, invented by Paul G. Tismer, has recently been placed on the market by the Ringless Piston Co., New York City. The outer shell and the inner shell-supporting member of a piston of this type are shown in Fig. 1. The outer shell is of uniform thickness (usually about ⅛ inch), and threads are cut at each end to fit the threaded ends of the inner member; the latter, shown at the right, carries the piston wrist-pin and also forms the piston head. An unthreaded outer shell is shown at the right in Fig. 2, while a completely assembled piston is shown at the left.

The ringless piston is so designed that there is very little tendency to force out the shell walls and increase the piston diameter at the upper end. Two advantages result from screwing the parts together: one is that the transmission of heat from the central member to the shell is delayed, and the other, that a small mechanical clearance is provided in the screw threads, so that the center may expand slightly within the shell without forcing the latter outward. The shell is of practically uniform thickness, and is thin enough to permit it to be maintained at about the same temperature as the cylinder wall; it is held from actual contact with the cylinder wall by an oil film.

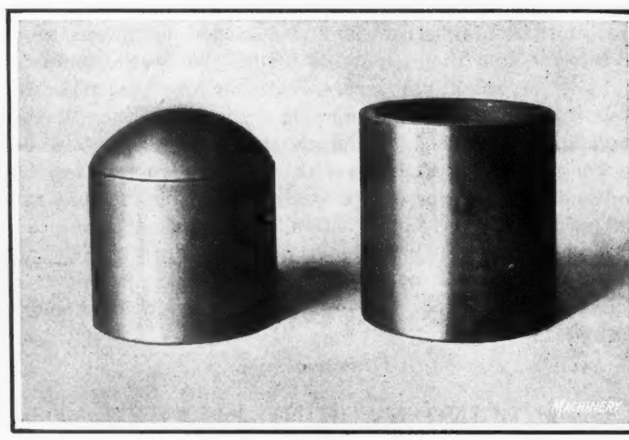


Fig. 2. Assembled Ringless Piston, and Shell

A small test engine was fitted with ringless pistons about four years ago and was run two or three years, intermittently, using various kinds of liquid fuel and operated with air-cooling, water-cooling, and with oil circulating in the cylinder jacket. Under all conditions of this test, it is stated that smooth piston action, satisfactory compression and no appreciable leakage were noted. A Ford automobile equipped with a set of ringless pistons was driven for two months under the worst possible conditions, and subjected to the most severe tests in order to demonstrate the reliability of the pistons. These pistons were originally fitted without grinding. It was found that the tool marks remained at the end of the test period, and that the pistons operated without appreciable wear. This would seem to indicate that the oil film between the piston and cylinder wall remained unbroken at all times. Ringless pistons are now being fitted into the engines of several makes of cars for extended tests, and are also being placed in the hands of at least two motor manufacturers for trial on their own test-blocks.

* * *

According to the *London and China Telegraph*, the Paris Academy of Science has been informed by M. Guillaume, director of the International Bureau of Weights and Measures, that the Japanese Parliament has passed a law making the adoption of the metric system obligatory in Japan. The metric system has been optional in Japan since 1893. In China the metric system was adopted in 1913 and should become obligatory in 1923.

BALL BEARINGS FOR MACHINE TOOLS

By HARRY N. PARSONS
Chief Engineer, U. S. Ball Bearing Mfg. Co., Chicago, Ill.

The use of the ball bearing in its present form in machinery construction, outside of its application to automotive machinery, is comparatively recent. The success that has resulted from the use of ball bearings in automotive machinery has encouraged the manufacturers of machinery, and especially machine tools, to investigate their possibilities in the machine tool field. The many advantages to be derived from their use in the construction of precision machinery have been apparent but not realized to the fullest extent, chiefly because of lack of information on the part of the machine manufacturers and an aversion on their part to experiment, due to the failures of previous attempts to apply ball bearings to such machinery.

This is particularly true with respect to the application of ball bearings to the main spindles of lathes, boring machines, and milling machines. Some experiments have been made in the adaptation of ball bearings to this field, but the attempts have been unsuccessful because of the lack of knowledge of the particular adaptation of ball bearing types to the peculiarities of the work in hand. The ball bearing manufacturers share to some extent in the lack of knowledge of the adaptability of certain types of ball bearings to this field, and it is only recently that they have made any great effort in the exploitation of ball bearings in the machine tool industry.

Ball bearing manufacturers today have secured information that is available to manufacturers of precision machinery, and any hesitancy on the part of the manufacturer to experiment may be easily overcome by the cooperation of the ball bearing manufacturer with the machine tool manufacturer. If the machine tool manufacturer is considering the use of ball bearings in his product, he has at his disposal the information that he desires in this respect from the ball bearing manufacturer.

All that is necessary is that the machine tool builder be frank in his statements and specifications concerning his machine. If he sends with his inquiry a drawing illustrating the locations in his construction in which he desires to use ball bearings, and accompanies that drawing with full information with respect to the operation of the machine, it will enable the ball bearing manufacturer to study his problem and determine the types and sizes of ball bearings to meet the requirements and exigencies of the design.

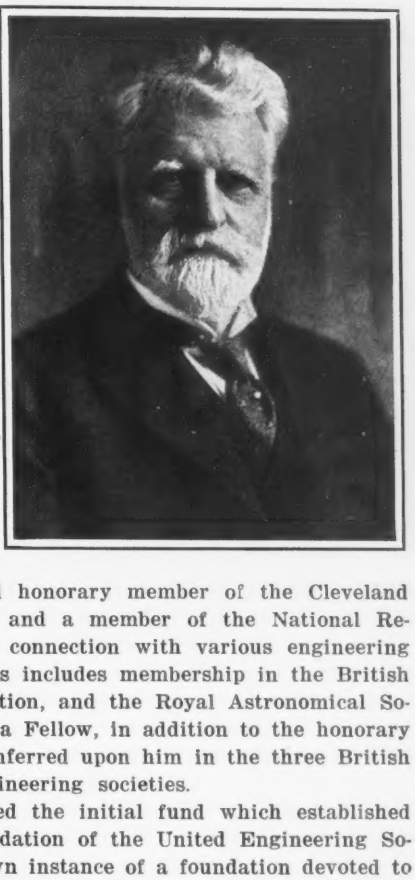
Every type and every size of bearing is best suited to some particular requirement. To endeavor to determine without previous knowledge the type and size best suited for any particular application invites trouble at the outset, and any machine tool builder will save himself considerable expense, time, and trouble in his work of applying ball bearings to his product, if he will first permit a reliable ball bearing manufacturer to study his problem and submit recommendations.

* * *

The United States Civil Service Commission announces an open competitive examination for instrument makers in the following departments: Coast and Geodetic Survey; Naval Observatory; Office of the Secretary of Agriculture; Bureau of Standards, Department of Commerce; and Weather Bureau. It is desired to secure instrument makers qualified to do repair work and make instruments from drawings. Applicants must have completed the eighth grade of common school and additional credit will be given for general or technical education in universities, colleges and technical schools of recognized standing, particularly for courses in physics, engineering, and allied subjects. Those interested should apply for Form 1312 to the Civil Service Commission, Washington, D. C., stating the title of the examination desired. Applications should be received not later than October 1.

AMBROSE SWASEY HONORED ABROAD

Ambrose Swasey, president of the Warner & Swasey Co., Cleveland, Ohio, and past president of the American Society of Mechanical Engineers, has visited Europe during the last two months as chairman of a delegation representing the four great national engineering societies, the American Society of Mechanical Engineers, the American Institute of Mining Engineers, the American Society of Civil Engineers, and the American Institute of Electrical Engineers. The specific purpose was to present the John Fritz medal to Sir Robert A. Hadfield of England, and to Dr. Eugene Schneider of France. During this visit Mr. Swasey was singularly honored both by engineering societies in Great Britain and France, and by the French Government. Honorary membership was conferred upon him in three British engineering societies, the Institute of Mechanical Engineers, the Institute of Mining and Metallurgy, and the Institution of Mining Engineers. The French Government made him an Officer of the Legion of Honor, of which he was made a Chevalier in 1900, and the Society of Civil Engineers of France conferred honorary membership upon him.



Ambrose Swasey has always been active in pioneer work in engineering societies as well as in engineering. He was one of the forty-eight men who organized the American Society of Mechanical Engineers. He served as president of that society in 1904, and in 1916 was made one of its honorary members. He is a past president and honorary member of the Cleveland Engineering Society, and a member of the National Research Council. His connection with various engineering and scientific societies includes membership in the British Astronomical Association, and the Royal Astronomical Society of which he is a Fellow, in addition to the honorary memberships now conferred upon him in the three British and one French engineering societies.

In 1914 he provided the initial fund which established the engineering foundation of the United Engineering Societies, the first known instance of a foundation devoted to engineering purposes and intended for promoting the good of mankind through the work of the engineer along the broadest lines.

In 1905 the Case School of Applied Science, Cleveland, Ohio, conferred upon him the degree of Doctor of Engineering, and in 1910 he received the degree of Doctor of Science from Denison University, Granville, Ohio. He has also held many positions of trust in the business world. He was president of the Cleveland Chamber of Commerce in 1905; and served as a member of the Jury of Awards at the Nashville, Pan-American, and St. Louis Expositions, and as vice-president of the Jury of Awards of the Jamestown Exposition.

* * *

It is estimated that at least 33,000 tractors were in operation in western Canada during the year 1920, the valuation of which was about $21,000,000. Tractors of 8-16 to 10-20 horsepower represent more than half the total sales in 1919 and 1920.

A NEW TOOL—

Brown & Sharpe Micrometer Depth Gauge No. 607

This new tool is of a design which appeals to the user of fine tools and whose excellence can be appreciated daily through its use. Its positive and quick adjustments, and its handiness of operation are points which make for faster work and accuracy —it is a desirable kit-member and helper. The illustration below shows the simplicity with which measuring rods are inserted. Measures 0 to 3" by thousandths of an inch.

BROWN & SHARPE MFG. CO.

OBITUARIES

J. L. Larson, sales manager of the Foote Bros. Gear & Machine Co., Chicago, Ill., died in Chicago on July 14.

John Jernberg, who had been instructor in forge practice at the Worcester Polytechnic Institute, Worcester, Mass., since 1882, recently died at his old home in Sweden at the age of sixty years. Mr. Jernberg, accompanied by his wife, left Worcester in May intending to spend his summer vacation abroad. He was known as an expert metallurgist.

Charles F. Beaman, a sheet-metal-working expert and member of the sales organization of the Adriance Machine Co., Brooklyn, N. Y., died July 7 in St. Catherine's Hospital, Omaha, Neb., after an illness of three weeks. Mr. Beaman was born in Independence, Iowa, in 1849, and devoted the greater part of his life to the sheet-metal-working and allied industries. He was connected with the sales organization of the E. W. Bliss Co. for thirty-two years, going from that organization to the Adriance Machine Co. in 1904. During his seventeen years' service with the Adriance organization, he traveled in the South and West, and it was while he was engaged in the performance of his duties that he was stricken with his fatal illness. He was a pioneer in introducing sheet-metal-working machines in Mexico.

Henry S. Manning, who at one time was a partner of the firm of Manning, Maxwell & Moore, Inc., dealers in machine tools, 119 W. 40th St., New York City, died July 9 in New York at the age of seventy-six. Mr. Manning originated the present business of Manning, Maxwell & Moore, Inc. After having been in business for himself for several years, he established the concern of H. S. Manning & Co., with headquarters at 111 Liberty St., New York, in which concern E. L. Maxwell became a partner in 1873, continuing his connection with the firm until his death in 1894. In 1880, Charles A. Moore became a partner, and it was at that time that the present name was adopted. In 1905 Mr. Moore purchased Mr. Manning's interest, and since that time Mr. Manning has been connected with Milliken Bros., structural iron and steel manufacturers, and the International Banking Corporation. He was a member of the American Society of Mechanical Engineers.

FRANCIS REED

Francis Reed, founder of the Francis Reed Co., Worcester, Mass., manufacturer of sensitive drilling machines, died July 11 at his home in Worcester, aged sixty-nine years. Mr. Reed was born in Danbury, N. H., and attended the public schools of that town. When he was nine years old, his family moved to Penacock, N. H., where he attended the Penacock Academy. Nine years later he went to Manchester, N. H., and it was there he learned the machinist's trade, starting as an apprentice with the Amoskeag Mills and later working at the Blood Locomotive Works. In 1880 he went to Worcester, and for two years was employed with the Union Water Meter Co., after which he spent three years with the Boynton-Plummer Machine Co. Leaving this company he entered the electrical business, forming the partnership of Reed & Page. In 1889 Mr. Reed bought out the business of George Burnham, manufacturer of drilling machines, located at 15 Herman St. He continued the business under the old name until 1902, when he started the present business at 43 Hammond St., under the name of Francis Reed Co. Mr. Reed developed a line of sensitive drilling machines, well known in this country and abroad. He is survived by two sons, Ralph G. and Merton F. Reed, both of whom are connected with the Francis Reed Co., and by whom the business will be carried on in the future.

PERSONALS

J. G. White has been appointed district sales manager at Detroit, Mich., of the Sharon Pressed Steel Co., Sharon, Pa. Mr. White's headquarters will be located at 1214 Dime Bank Bldg., Detroit.

Victor M. Summa, a frequent contributor to the columns of Machinery, has opened an office at 415 Merchants-Laclede Bldg., 408 Olive St., St. Louis, Mo., to engage in general engineering practice.

C. G. Johnson, formerly in charge of thread gage manufacturing in the small tool division of the Taft-Peirce Mfg. Co., Woonsocket, R. I., left that company on June 25 to engage in business for himself in Hartford, Conn.

George Greenlee, formerly general superintendent and mechanical engineer for the National Wire Wheel Works, Geneva, N. Y., has become associated in the same capacity with the Morrison Machine Products, Inc., Rochester, N. Y., manufacturers of collets for lathes and screw machines.

W. R. Hyde, for several years special western representative (with headquarters at Chicago) of the Hilo Varnish Corporation, Brooklyn, N. Y., will take over the New York and Pennsylvania territory of the company, formerly covered by J. Frank Brown. Mr. Hyde will make his headquarters at Buffalo for the present.

R. G. White, manager of the Cleveland branch of B. M. Jones & Co., Inc., has been appointed special western representative and will be located in Chicago. His headquarters will be with the company's western sales agents, Crerar, Adams & Co., 259 E. Erie St., where complete stocks of mushet and "Titanic" tool steels and Taylor's "Best Yorkshire" iron are carried.

John D. Hurley, president of the Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill., manufacturer of "Thor" air and electric tools, sailed from New York City on the steamship *Olympic*, July 16, for an extended trip throughout continental Europe. Mr. Hurley was accompanied by his wife, and will make his trip one of combined business and pleasure.

Robert D. Black, formerly assistant sales manager of the Black & Decker Mfg. Co., Towson Heights, Baltimore, Md., has been appointed manager of the company's Philadelphia branch office with headquarters at 318 N. Broad St. Mr. Black succeeds W. C. Allen, who has been made a special factory representative, with headquarters at the company's Cleveland branch office, 6225 Carnegie Ave.

I. D. Bielostozky is at present in the United States representing the firm of Morris & Bramer of Petrograd, Russia. He is desirous of getting in touch with high-class machine tool manufacturers with a view to securing their representation in Vladivostok, Russia. Morris & Bramer also intend to extend their activities to China, Japan, and Finland. Mr. Bielostozky expects to be in this country for at least three months and can be addressed in care of the W. P. Neth Co., 44 Whitehall St., New York City. He would be glad to receive complete catalogues and price lists from machine tool manufacturers who may be interested.

C. E. Davies has been appointed managing editor of "Mechanical Engineering"—the journal of the American Society of Mechanical Engineers—succeeding the late Lester G. French. Mr. Davies joined the editorial staff of the society in March, 1920, as associate editor of "Mechanical Engineering" and assistant secretary in charge of meetings and publicity. Previous to his association with the society he was connected with the Smith Premier Works of the Remington Typewriter Co., Syracuse, N. Y. During the war he was in the Ordnance Department at the Frankford Arsenal, serving as assistant production superintendent on the artillery ammunition division, and later as superintendent of the fuse shop.

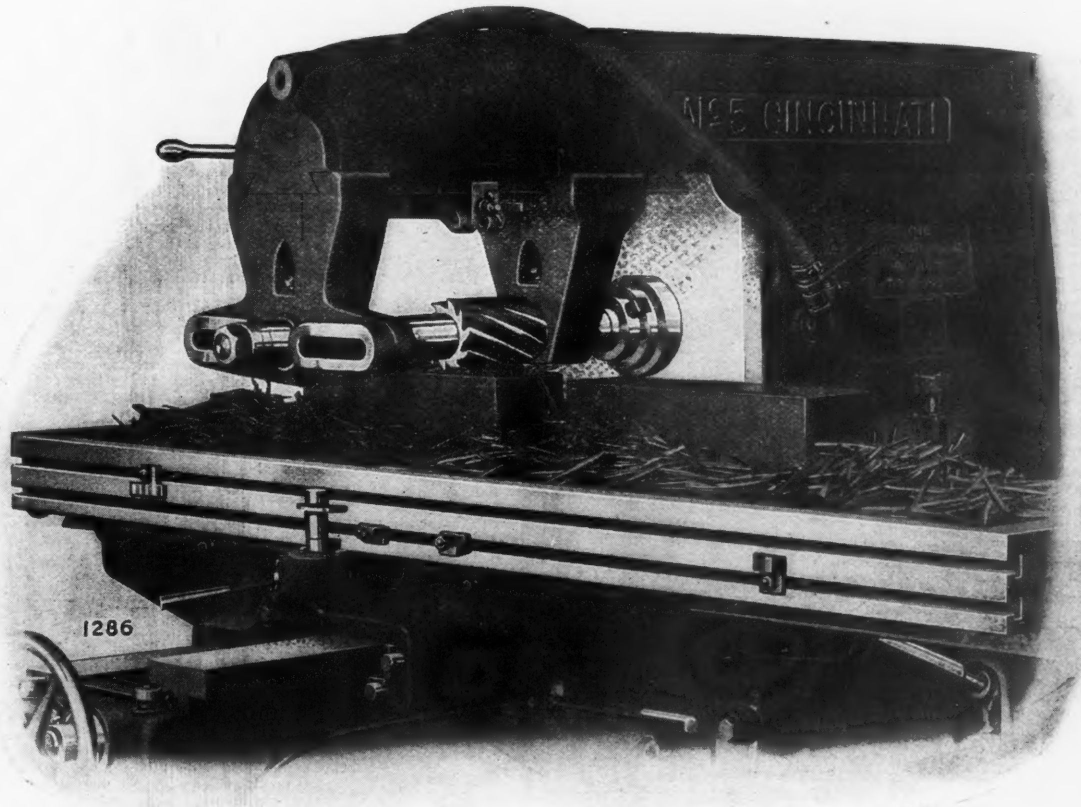
Vance McCarty, who was formerly vice-president of the Edward R. Ladew Co., New York City, has become associated with the Chicago Belting Co., 113 N. Green St., Chicago, Ill., in the capacity of vice-president of the corporation. Mr. McCarty has had extensive experience in the leather belting industry, having been associated with the Ladew company for twenty-one years, the first five of which he spent in the various departments of the manufacturing end of the business, and the last sixteen in the sales end of the work. Mr. McCarty will make his headquarters at the New York branch of the Chicago Belting Co., 127 Water St., New York City. He will have charge of all sales in New York, Pennsylvania, Connecticut, Rhode Island, New Jersey, Maryland, Delaware, Virginia, West Virginia, and District of Columbia, and will also have supervision over all export sales.

24 Cubic Inches of Steel Removed Without Braces on the No. 5 Cincinnati

THE CINCINNATI RECTANGULAR OVERARM

(PATENTED)

enables the new Nos. 4 and 5 machines to take cuts up to their normal rated capacity without the use of braces.



Material, machinery steel, cutter, 4½-in. diameter, Cincinnati design spiral mill, 2 in. arbor

Cut, ¼-in. deep, 5 in. wide Feed, 19 in. per minute

Removing 23¾ cubic inches of steel per minute—without the use of braces

THE CINCINNATI MILLING MACHINE CO.

CINCINNATI OHIO, U.S.A.

NEW JOURNAL OF MANAGEMENT

The first number of a new journal *Management Engineering* has made its appearance. It is edited by L. P. Alford, formerly editor of *Industrial Management* and previous to that of the *American Machinist*. The new journal is devoted entirely to management problems, the first number containing articles on labor costs, storekeeping, cost accounting, accident prevention, management education, and other subjects closely connected with the management of all types of industrial undertakings. It is published by the Ronald Press Co., New York City.

RIVET CUTTING RECORD

In June MACHINERY, page 926, mention was made of an operator who cut 1038 rivets in two hours and forty-six minutes, using an oxy-acetylene blowpipe with a rivet-cutting nozzle. Of this number 683 were 5/8-inch rivets; 228, 3/4-inch rivets; and 127, 7/8-inch rivets. Referring to this rivet cutting record, H. K. Griggs of Portland, Me., states that about a year ago an operator of the Portland Co., using an ordinary Davis-Bournonville torch with bent tip, cut over four hundred 5/8-inch rivets in one hour on the water tank of the S. S. *Hindustan*.

COMING EVENTS

September 7-28—Shipping, Engineering and Machinery Exhibition, Olympia, London, W., England. General Manager, Frederic W. Bridges, 36-38 Whitefriars St., Fleet St., London, E.C.4.

September 14-16—Annual convention of the National Association of Cost Accountants in Cleveland, Ohio; headquarters, Hotel Cleveland. Secretary's address, 233 Woolworth Bldg., New York City.

September 19-24—Third annual convention and exhibition of the American Society for Steel Treating in Indianapolis, Ind. Secretary, W. H. Eisenman, 4600 Prospect Ave., Cleveland, Ohio.

September 28-October 8—New York Electrical Exposition at the 71st Regiment Armory, Park Ave. and 34th St., New York City. For information relating to exhibits, apply to Norman Maul, the Electrical Show Co., 130 E. 15th St., New York City, Room 828.

October 3-4—Regional meeting of the American Society of Mechanical Engineers in Cleveland, Ohio; headquarters, Hotel Winton.

November 4-5—Regional meeting of the American Society of Mechanical Engineers in Kansas City, Mo.

May 8-11, 1922—Spring meeting of the American Society of Mechanical Engineers in Atlanta, Ga. Assistant Secretary (Meetings), C. E. Davies, 29 W. 39th St., New York City.

SOCIETIES, SCHOOLS AND COLLEGES

University of Delaware, Newark, Del. Annual catalogue for 1920-1921 containing calendar and announcements for 1921-1922.

Cooper Union, Fourth Ave. and Eighth St., New York City. General circular of information embracing all the courses of study pursued in the institution.

Hebrew Technical Institute, Stuyvesant and 9th Sts., New York City. Catalogue for the year 1921-1922, containing calendar, requirements for admission, courses of instruction, etc.

Armour Institute of Technology, 33rd and Federal Sts., Chicago, Ill. Bulletin for May 1920, containing calendar, courses of study, and other general information concerning the institute.

NEW BOOKS AND PAMPHLETS

Investigation of Warm-air Furnaces and Heating Systems. By A. C. Willard, A. P. Kratz, and V. S. Day. 145 pages, 6 by 9 inches. Published by the Engineering Experiment Station of the University of Illinois, Urbana, Ill., as Bulletin No. 120.

Effects on Concrete of Immersion in Boiling Water and Oven Drying. By W. J. Schlick. 24 pages, 6 by 9 inches. Published by the Engineering Experiment Station of the Iowa State College of Agriculture and Mechanic Arts, Ames, Iowa, as Bulletin No. 59.

Scientific Selling and Advertising. By Arthur Dunn. 119 pages, 5 by 7½ inches. Published by the author, Quincy, Ill. Price, $2.50.

This little book on advertising and selling deals in a brief concise way with the problems involved. It is divided into four parts and an appendix, the four parts dealing respectively with Human Energy; Essentials of Success; Scientific Method of Presenting your Products; and How Related to War and Reconstruction. The appendix contains an application of the system to different classes of salesmanship.

Iron and Steel in Sweden. 183 pages, 7½ by 10 inches. Published by Svenska Teknologforeningens Forlag, Stockholm, Sweden.

The present work, printed in the English language, is intended to give information on the subject of Swedish iron and steel and its production, to American and English readers. The book contains, first, a general review of the iron and steel industry in Sweden, together with a map showing the location of the various works. It then describes in detail, in articles profusely illustrated, the leading iron and steel works in the country, and contains, in addition, a list of the producers of iron and steel products in Sweden.

Year Book for 1921, of the American Chamber of Commerce in London. 111 pages, 6 by 9 inches. Published by the American Chamber of Commerce, 8 Waterloo Place, Pall Mall, S. W. 1, London, England. Price, 5s.

This book comprises a classified trade directory, for the benefit of Americans who are interested in selling in the British market or for English people who are interested in the American market. It contains an alphabetical and classified list of members of the American Chamber of Commerce in London, indexed and cross-indexed for ready reference, giving the name, address, and business in each case. It should be useful in selling, buying, appointing agents, or securing agencies.

Handbook of Standard Details for Engineers, Draftsmen, and Students. By Charles H. Hughes. 312 pages, 4½ by 7 inches. Published by D. Appleton & Co., 35 W. 32nd St., New York City. Price, $6.

This book was compiled especially for engineers and draftsmen, so that they might have in a convenient form drawings, tables, and formulas of standard details for use in designing. Most of the material in the book is similar to that found in the general engineering handbooks. The tables cover fastenings; power transmission; pipe, tubes, and fittings; rope and chain fittings; miscellaneous details; structural details; weights and measures; strength of materials; specific gravities; etc.

Financing an Enterprise. By Hugh R. Conyngton. 667 pages, 6 by 9 inches. Published in three volumes by the Ronald Press Co., 20 Vesey St., New York City. Price, $7.

The three volumes of this work deal, respectively, with the enterprise to be financed; its organization; and the actual financing problems themselves. In the first volume the main subjects discussed are the conditions and the methods of financing; the investigation of an enterprise; and the protection of an enterprise. The second volume deals with the shaping up of an enterprise; its capitalization; and special corporate adjustments. The third volume treats of preliminaries to the actual presentation to financial underwriters; private and public presentation of an enterprise; prospectus and other presentation papers; and special features of promotion. These volumes should be of considerable interest to business men planning to finance or increase the capitalization of an enterprise.

A Manual of Marine Engineering. By A. E. Seaton. 984 pages, 6 by 9 inches. Published by D. Van Nostrand Co., 8 Warren St., New York City. Price, $10.

This is the eighteenth edition of a well-known work on marine engineering, covering the design, construction, and working of marine machinery. The new edition has been thoroughly revised, greatly enlarged, and largely rewritten in order to bring it up to date. Since the issue of the last edition the changes in engineering practice have been many and great. Special appendixes have been added to deal with heavy oil engines, geared turbines, and superheaters. The work is doubtless one of the most complete in existence on the subject with which it deals. The thirty-one chapters of the book deal with practically every phase of marine engineering—with the properties of steam, and the different constructional details of marine engines and turbines, condensers, pumps, valve gears, propellers, and auxiliary machinery, as well as with boilers. It is impossible in a brief review to do justice to so comprehensive a work, but the fact that the book is appearing in its eighteenth edition, revised and brought up to date, would appear to be all that need be said in its favor.

Sheet Metal Drafting. By Ellsworth M. Longfield. 236 pages, 6 by 9 inches; 327 illustrations. Published by the McGraw-Hill Book Co., Inc., New York City. Price, $2.25.

The author of this book is head of the sheet metal department of the Boston Trade School, and the book is one of the industrial education series prepared by the Extension Division of the University of Wisconsin for correspondence instruction. It comprises a text-book on the underlying principles of sheet metal pattern drafting. The arrangement and presentation of the material have been successfully used for several years in the teaching of the subject. The problems in related mathematics point out the application of mathematical principles to sheet metal work, and serve as a guide for the proper correlation of the work in mathematics, drawing, and shop practice. The material is divided into sixteen chapters dealing with the following subjects: Rectilinear Figures; Wired Cylinders; Cylinders Cut by Planes; Intersecting Cylinders; Cones of Revolution; Intersecting Rectangular Prisms; Planning for Quantity Production; Sections Formed by Cutting Planes; Frustums of Rectangular Pyramids; Combinations of Various Solids; Frustums of Cones; Return and Face Miters; Triangulation of Scalene Cones; Triangulation of Transition Pieces; Developments by Sections; and Developed and Extended Sections.

The Engineering Index 1920. 586 pages, 6 by 9 inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York City. Price, $6.

This is the second volume of the Engineering Index to be issued by the American Society of Mechanical Engineers. The alphabetical or dictionary arrangement, found so convenient and satisfactory in the 1919 volume, has been retained. Each item contains the exact title of the article indexed; the author's name, if given; the name of the periodical in which the article appeared; the volume, number, and date of publication; and the page numbers and number of figures in the article. It also includes a brief note summarizing the article indexed, and this feature, together with the numerous cross-references throughout the volume, makes it possible for a person to confine his search to those particular articles which bear directly upon his problem. The volume contains nearly 14,000 items referring to articles in about 700 engineering and allied technical publications. In preparing the Index the engineering staff of the society has reviewed the 1200 different periodicals, reports and publications regularly received by the Engineering Societies library in New York. These periodicals are printed in ten different languages and comprise what is believed to be the most complete collection of scientific and engineering publications in the world.

Thomas' Register of American Manufacturers. 4218 pages, exclusive of advertising, 10 by 12 inches. Published by the Thomas Publishing Co., 129 Lafayette St., New York City. Price, $15.

The twelfth edition of Thomas' well-known purchasing guide and directory contains a considerable amount of additional material not found in previous editions. The arrangement is the same as in former issues. The work is divided into seven main sections, the first of which is an index to the classified section of products and businesses, this index being so thoroughly cross-indexed that it covers by itself 172 pages. This section, in order to facilitate easy reference, is printed on yellow paper. The next section, which is by far the largest section of the work, covers 3325 pages, and is devoted to a list of names and addresses of manufacturers of machines, devices, products, and materials classified according to their business. This list is thoroughly subdivided so that reference can be made to a specific class of manufacturers with little difficulty, and in addition to the index in the first section of the book referred to, the main classified list has so many cross-references that if the index is always referred to, the particular line of manufacturers to be found can be readily located. This section of the work is printed on white paper. Next follows a section listing the representative banks in the United States, which covers 23 pages. Another list of 9 pages gives the names and addresses and the name of the secretary of commercial organizations. A section of 12 pages gives the name, address, and subscription price of all the leading trade journals in the country. The third main section of the book, covering 414 pages, gives a complete alphabetical index of manufacturers in the United States, their home offices, branches, names of officers, sales manager, purchasing agent, etc. This section is printed on blue paper. The fourth alphabetical section gives a list of trade names and brands, including the names and addresses of the manufacturers. This section covers 263 pages, and is printed on pink paper. Another

feature of the work is the list of export and import houses, steamship lines, and forwarding agents listed on the first of the yellow pages toward the end of the book. This list, it is stated, contains only responsible concerns, and should therefore be of considerable value to American merchants and manufacturers. In addition, the work contains numerous advertising pages, there being in all 2372 advertisers and 6261 separate advertisements. Buyers and purchasing agents in all industries will find this work useful in answering the many questions that come up in their daily work and in locating the sources of supply for their products or the manufacturers of machinery, devices, or materials which they have to buy. It will also prove useful to the sales manager or sales promotion department in determining the possible number of customers for any given product, and it is therefore a work that may be recommended as a reference book or directory.

NEW CATALOGUES AND CIRCULARS

Northern Engineering Works, Detroit, Mich. Bulletin 520, illustrating installations of electric traveling grab-bucket cranes, designed for severe classes of service.

National Machinery Co., Tiffin, Ohio. National Forging Machine Talk No. 41, describing the making of clutch hub drive rings on a National heavy-pattern forging machine.

Smith Forge Co., Camden, N. J. Circular illustrating the Smith safety cargo hook, a special open-hearth steel drop-forged hook designed to prevent a load from slipping.

General Electric Co., Schenectady, N. Y. Bulletin 48121.1, describing in detail a line of direct-current mill-type motors developed to meet the severe requirements found in steel mills.

Cutler-Hammer Mfg. Co., Milwaukee, Wis. Bulletin 9141, illustrating and describing the new C-H auto-transformer starter for use with squirrel-cage induction motors, in capacities from 5 horsepower up.

Pearson-Scott Co., Indianapolis, Ind. Catalogue illustrating and describing the "Iron Man"—an attachment for hand screw machines and turret lathes, by means of which the operation of these machines is made fully automatic.

Cutter Co., Philadelphia, Pa. Circular containing data on the "U-re-lite Senior"—a combined covered switch and circuit breaker for application to machine tools and other machinery, which is made in capacities of from 5 to 150 amperes.

New Departure Mfg. Co., Bristol, Conn. Loose-leaf data sheets, 130, 131, 132 and 133 FE, containing illustrations and descriptions of ball bearing installations on a die-tapping machine, automatic drill press head, multiple-speed drilling machine countershaft, and planetary gear spindle pulley.

Rickert-Shafer Co., Erie, Pa. Bulletin 8, descriptive of the features of the R-S adjustable boring head, which is a universal tool suitable for use on any drilling, turning, or boring machine. The circular illustrates the use of this type of boring head on the different classes of work for which it is adapted.

John Bath & Co., Inc., Worcester, Mass. Bulletin 20, describing the construction of the Bath internal thread micrometer which is a combination adjustable plug gage and micrometer for accurately measuring threaded holes, so that it is possible to tell at a glance whether or not the part is within the prescribed limits.

Ingersoll-Rand Co., 11 Broadway, New York City. Booklet illustrating and describing the complete line of "Little David" pneumatic tool accessories, including air hose, hose couplings, hose clamps, drill chucks, chisels and chisel blanks, rivet sets and blanks, wire brushes, oils and greases, rail bonding drills, rail drills, and railroad kit boxes.

Conradson Machine Tool Co., Green Bay, Wis. Catalogue entitled "Contract Work," showing examples of the Conradson line of production machinery for producing details for automobiles, locomotives, electrical machinery, tractors, gas engines, etc. Examples of the machine details which this concern is prepared to contract for are also illustrated.

Link-Belt Co., 910 S. Michigan Ave., Chicago, Ill. New steel chain data book No. 475, presenting completely the Link-Belt heavier types of rugged steel chains used for power transmission, as well as elevating and conveying chains. The line of chains shown in this book ranges from the rugged slow-speed classes to the machine-finished high-speed chains.

Jones Machine Tool Works, Philadelphia, Pa. Circular illustrating and describing the features of construction of the Jones horizontal boring, drilling, and milling machine, designed for boring cylinders, motor housings, or any other horizontal boring mill work. Complete specifications are given for this line of machines, which includes six sizes, namely 3, 3½, 4, 4½, 5, and 6 inches diameter of spindle.

Rhodes Mfg. Co., Hartford, Conn. Loose-leaf catalogue containing pamphlets illustrating and describing the Rhodes 7-inch horizontal crank shaper for shaping small tool and die work and machining all small production work; the 3½-inch vertical slotter for slotting small complicated dies and tools; and the combined horizontal shaper and vertical slotter, which can be quickly changed from a horizontal shaper with a 7-inch stroke to a vertical slotter with a stroke of 3½ inches.

W. S. Rockwell Co., 50 Church St., New York City. Bulletin 230, containing a series of papers dealing with the principles governing industrial heating operations. This bulletin is not a mere catalogue of the firm's products, but contains considerable information of general value. The subjects treated in the papers are factors governing quality and cost of heat-treated products; relation of temperature control to uniformly heated product; selection of furnaces; relation of price of fuel to cost of production; and influence of furnace design on quality and cost of product.

Farrell-Cheek Steel Foundry Co., Sandusky, Ohio. Catalogue (41 pages, 9 by 12 inches, printed in two colors) entitled "The Illustrated Story of a Farrell-Cheek Steel Casting," containing a detailed description of the different steps in the production of steel castings in this company's plant. The catalogue is fully illustrated with views of the different departments and the operations involved, so that the reader has the advantage of a trip through the factory without having to travel to Sandusky. Every alternate page contains views showing the application of these castings in different classes of machinery.

Geometric Tool Co., New Haven, Conn. Circular showing the different styles of Geometric self-opening and adjustable die-heads, and giving information on the class of work for which each is particularly adapted. The circular also shows Geometric chaser grinders, threading machines, and Jarvis high-speed tapping devices and quick-change chucks and collets. Circular containing illustrated descriptions of the Jarvis high-speed tapping device, Jarvis quick-change chucks and collets, and the Jarvis combination tapping device and quick-change chuck. Complete specifications for these tools are given, and instructions for operating the tapping device are included.

Jones & Lamson Machine Co., Springfield, Vt. Cloth-bound book containing 63 pages, 6 by 9 inches, descriptive of the Hartness automatic chucking lathe, designed for rapid production. Following the detailed description of the machine, which is fully illustrated with both half-tone and line engravings, is a section showing examples of quantity production on this machine. Next comes a description of the operation, tooling, and lubrication, in connection with which illustrations of tooling equipment for typical classes of work are presented. The last section of the book illustrates other products of the company, including Hartness single-spindle flat turret lathes, double-spindle flat turret lathes, standard Fay automatic lathes, automatic dies, and the Hartness screw thread comparator.

TRADE NOTES

National Machinery Co., Tiffin, Ohio, manufacturer of bolt, nut, and forging machinery, has opened an eastern sales office at Room 637, Knickerbocker Bldg., Broadway and 42nd St., New York City. F. J. Mawby will be in charge of the new office.

Walworth Mfg. Co., whose general offices have been at the Boston factory, First and O Sts., Boston, Mass., has moved its general offices to Pearl and High Sts., Boston. The building embraces an entire block on High St., and the offices cover two floors.

Royal Forwarding Co., Inc., 24 Stone St., New York City, announces that the company is in a position to advise manufacturers in the United States as to lists of dealers and merchants in Reval, Esthonia, and Riga, Latvia, who would be willing to handle American goods in those countries.

Universal Crane Co., Swetland Bldg., Cleveland, Ohio, manufacturer of portable gasoline or electric locomotive cranes, announces that the Allied Machinery Co. of America, 51 Chambers St., New York City, has been appointed foreign representative for the company in all countries except Canada.

Pennant Tool & Engineering Co. is a new concern located at 125 E. Warder St., Springfield, Ohio, which is engaged in making special tools and doing contract work. The officers of the company are H. H. Swope, president and treasurer; C. F. Chronister, vice-president; and George Metcalf, secretary.

B. M. Jones & Co., Inc., 192 Chambers St., New York City, announces that its Cleveland branch at 115 St. Clair Ave. N. W., is now being managed by the Connelly & Kendal Co., H. Connelly and J. Day having direct charge of the sale of double mushet high-speed steel and "Titanic" carbon tool steels.

Electric Furnace Co., Alliance, Ohio, announces that it has received more orders for Bailey electric furnaces during the month of June than in any single month in the last two years. These orders include standard brass melting units, car furnaces for steel plant purposes, and a special electric enameling equipment.

Goddard & Goddard Co., Inc., Detroit, Mich., announces the opening of an eastern sales office and permanent exhibit of high-speed steel milling cutters in the building of the Manufacturers' Exhibit, Inc., at 45 W. 18th St., New York City. James W. Sederquist, eastern sales manager, is in charge of the New York office.

Brown Instrument Co., Philadelphia, Pa., manufacturer of instruments for indicating and recording temperature, pressure, speed, operation and draft, has opened a branch office at 201 Reliance Bank Bldg., 1634 Euclid Ave., Cleveland, Ohio. This makes a total of eleven district offices maintained by the company.

Barbour, Love & Woodward, Inc., machine tool dealers, formerly of 149 Broadway, New York City, have now moved from their temporary office and warehouse at 131 Washington St., to new offices and show rooms at 45 W. 18th St. Surplus stock will be carried in the building for the convenience of those desiring to inspect machines.

Shields Cutter Co., 18511 Euclid Ave., Cleveland, Ohio, maker of milling cutters and special cutting tools, will maintain a branch office and store beginning August 1, at 192 Chambers St., New York City (telephone, Barclay 8796) in charge of J. V. Carlin, district manager. This store will make it possible to serve the New York district adequately with milling cutters and special cutting tools.

Swadeshi Brass & Iron Works, 233 Kika St., Bombay, No. 4, India, announce that they are in the market for a number of small, medium, and large machine tools, including 3 planers, 6 shapers, 8 milling machines, 10 screw machines, 4 slotters, 8 grinding machines, 8 brass finishing lathes, 10 engine lathes, 6 automatic profiling machines, 3 shaft-turning lathes, 12 drilling machines of different sizes, 2 cold-sawing machines, and 3 hacksaw machines.

Dominion Oxygen Co., Ltd., broke ground in the middle of July for a new oxygen plant at Montreal, Canada, which will double the company's present capacity. The building will be 100 by 100 feet, and will be substantially a duplicate of the Toronto plant, which until now has supplied oxygen to Canadian users through five distributing stations. This is the second of the five producing plants projected at the time the company was organized last year.

Sharon Pressed Steel Co., Sharon, Pa., has recently been reorganized, and Harry W. Torney of Torney & Co., has been elected president. The company states that it is now in a position to handle the production and delivery of car and truck frames up to 1500 per day. Arthur W. Swan, general manager, is in charge of manufacture. In addition to its automobile and truck frame business, the company is equipped with machinery for forging and hot-pressed work.

Link-Belt Co., 910 S. Michigan Ave., Chicago, Ill., has acquired all the capital stock of the **H. W. Caldwell & Son Co.**, and Frank C. Caldwell has been elected a director of the Link-Belt Co. By this combination the Link-Belt Co. has added two new lines—helicoid conveyors, and power transmission machinery—to its line of manufactures. The Caldwell plant will continue to be operated as a separate unit, and there will be no change in the policy or product. The management will also remain substantially the same.

National Machinery Sales Co., Chicago, Ill., which was recently incorporated, has opened headquarters at 28 N. Desplaines St., Chicago. The officers of the new concern are James L. Gough, president and treasurer; James Jay Sheridan, secretary; and George D. Benson, assistant secretary. Mr. Gough was until recently president of the Federal Machinery Sales Co. of Chicago, which company he was largely instrumental in founding in 1915, and has been in the machine tool business for more than twenty-five years. Mr. Sheridan was until recently vice-president of the Federal Machinery Sales Co., and Mr. Benson was associated with the same company in the capacity of salesman.

Morse Chain Co., Ithaca, N. Y., announces that the company will have on exhibition at the Seventh National Exposition of Chemical Industries, held at the Eighth Coast Artillery Armory, New York City, during the week beginning September 12, a large Morse rocker joint silent chain drive with the washers of the chain removed from one side and a revolving shutter ingeniously arranged so that the rocking action of the joint can be followed as the chain goes on and off the sprockets. This drive is capable of transmitting 100 horsepower and withstanding occasional overload of 100 per cent. There will also be other small drives used for connecting individual motors to machines, and a number of samples of different sizes of chain ranging from ⅜ inch pitch to 3 inches pitch, in several widths, for horsepowers ranging from ½ to 5000. F. G. Anderson, New York manager of sales, will be in charge of the exhibition.

The Machine Tool Industry

THERE has been no change in the situation in the machine tool field during the past month. Business is very quiet, and machine tool plants are working with greatly reduced forces or are practically shut down for the time being. Manufacturers and dealers are well stocked up on machine tools, and should one judge the outlook by present conditions in this field alone, it would be distinctly discouraging. Fortunately it is neither wise nor necessary to judge entirely by the conditions in a single industry; and the reports of business as a whole throughout the country indicate that we have passed the lowest point of the depression. Secretary Hoover says: "Business has made the turn."

General Industrial Review

The textile industries, for example, present quite an accurate index to general business conditions and prospects. These industries were the first to feel the depression, over a year ago, and now they are the first to return to conditions showing a satisfactory degree of activity. In the woolen industry particularly, business is being carried on at a high rate. The American Woolen Co. is operating at 95 per cent of capacity, which is practically as high a rate as it has ever attained, and most, if not all, the New England woolen and worsted industries are operating at 75 per cent capacity or better.

Reports from retail stores handling all lines throughout the country, as published by the Federal Reserve Banks, show that net sales in dollars are very nearly equal to the sales for the corresponding month last year; and as retail prices have been considerably reduced in the past twelve months, this means that in actual goods the volume of sales is larger now than a year ago.

Another indication of improved industrial conditions is the freight car movement. During January and February the loaded freight car movement was only 85 per cent of the average freight car movement during the first six months of 1920; in March and April this rose to 87 per cent; and in May—the last month on record—to 93 per cent; so that the actual business done in the country is only a small percentage below that done during the first six months of 1920, which was regarded as very satisfactory.

One of the electric furnace companies reports more orders in the month of June than for any other single month during the past two years. Most of the sales were made to concerns not particularly busy at the present time, but who purchased equipment in the firm belief that by the time the furnaces were installed and ready for operation, business would be such as to justify the present expenditure. Early returns for the month of July indicated equally good business.

The rapid restoration to normal business in several industries has been greatly facilitated by the readjustment in prices of raw materials. It is interesting to note that the raw materials in the cotton, leather, and rubber industries (as well as basic necessities in the food production industries, such as cattle and corn) now sell at wholesale below their average 1913 prices; while the basic raw material in the iron and steel field (pig iron, as well as structural steel and bars) still sells at about 35 per cent above the average 1913 price. There has been recent outspoken criticism of the high prices of raw materials in the iron and steel field, as compared with some of the other industrial fields, and it has been charged that the slow resumption of business in the metal-working industries is partly due to the reluctance of the iron and steel interests to reduce prices on the raw materials used in those industries. Whatever basis there may be for this, it is a fact that the readjustment of prices of the raw materials in some other fields has been much more rapid.

It has been predicted with reasonable certainty that there will be some railroad business in the early fall, because the condition of the rolling stock, and even of tracks in some cases, will force action. One middle-western railroad is asking for bids for over 100 locomotives, which is considered a sign of revival of buying by the railroads.

Automobile Industry

The reduction in the prices of many well-known automobiles, ranging from 5 to 35 per cent, is expected to have a favorable effect upon the market for cars. The schedules for the Ford plants for July call for over 100,000 cars. The output during June set a new record in the history of the company, the total, including Canadian and foreign branches, reaching 116,000 cars, as against 111,000 in May. A new record for a single day was set when 4300 cars were turned out. News from other automobile companies varies considerably, some reporting good business, while others find prospects less encouraging. Buick is said to be planning to increase production for the rest of the year. The same report is made by the Willys-Overland Co. Studebaker has been running practically at full capacity for months. Signs of better tire business are appearing. Goodyear has re-employed 3000 men, and Fiske has added a night shift and is increasing the day force. A survey of the Akron rubber companies indicates that they are running from 50 to 60 per cent capacity, which is remarkable under the circumstances, as their total capacity is enormous.

The healthy, if painful, process of deflation and readjustment is steadily working out the economic problem. That way lies the road to business recovery and prosperity.

Production Machines for Your Drilling and Tapping Jobs

Some one of the LELAND-GIFFORD machines is adapted to your drilling from the smallest hole up to 3/4″ diameter, and one of our tapping attachments will do your tapping from the smallest up to 5/8″ diameter.

Our service department is ready to help you with your drilling and tapping problems and to advise regarding jigs and fixtures.

We Make Multiple Heads If Your Work Requires Them

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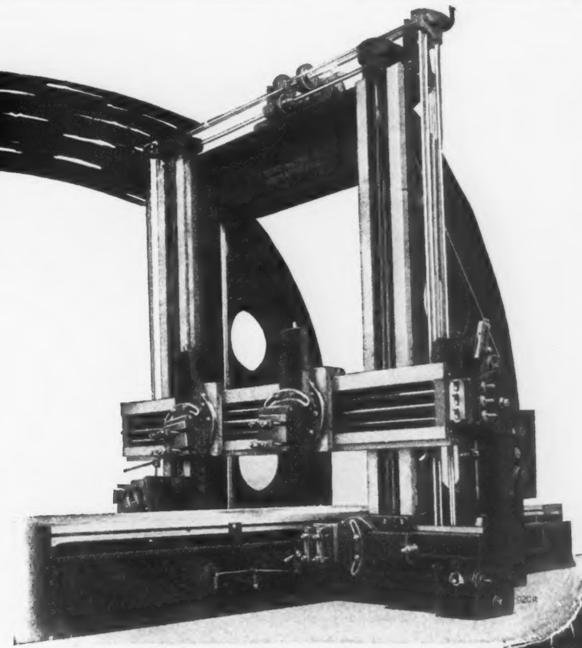

BETTS PLANERS

Box Form Table

Closed Top Bed

The tables on all Betts Planers are of our improved double plate box construction so that no chips can reach the driving gears or vees. These tables are extra heavy and of unusual depth.

The openings at the side of tables are extra wide and have square corners. This allows the chip rake clear passage without any obstructing flanges—a feature of all Betts Planers.

The bed is full box type, strongly reinforced which completely encloses the top except where the bull wheel engages the rack.

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We can save you money.

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Slotters, etc.

BETTS
MACHINE TOOLS

The Lodge & Shipley Manufacturing Lathe

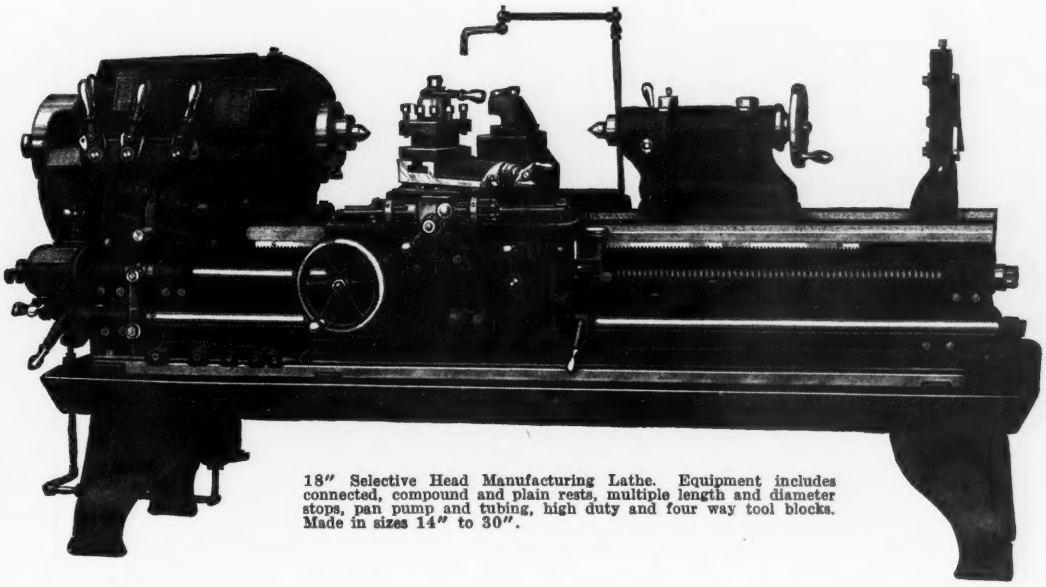
is our standard engine lathe fitted with attachments which enable duplicate pieces of work to be turned with a time saving of 25 to 50 per cent. Think of that!

Think of being able to save almost one-half the usual time taken to turn parts on the ordinary engine lathe. Not only is this possible but a high standard of accuracy, better even than hand measurement, is continuously maintained.

The live, wideawake manufacturer fully realizes the necessity of keeping down the *cost per piece* and this lathe surely fills the bill. Think of the time it can save, with the subsequent reduction in the *cost per piece!*

Taking it from the standpoint of the operator, he has the utmost confidence in the accuracy of the stops. The convenience of four cutting tools on the compound rest and another on the rear rest ready for instant use, forms a combination hard to do without.

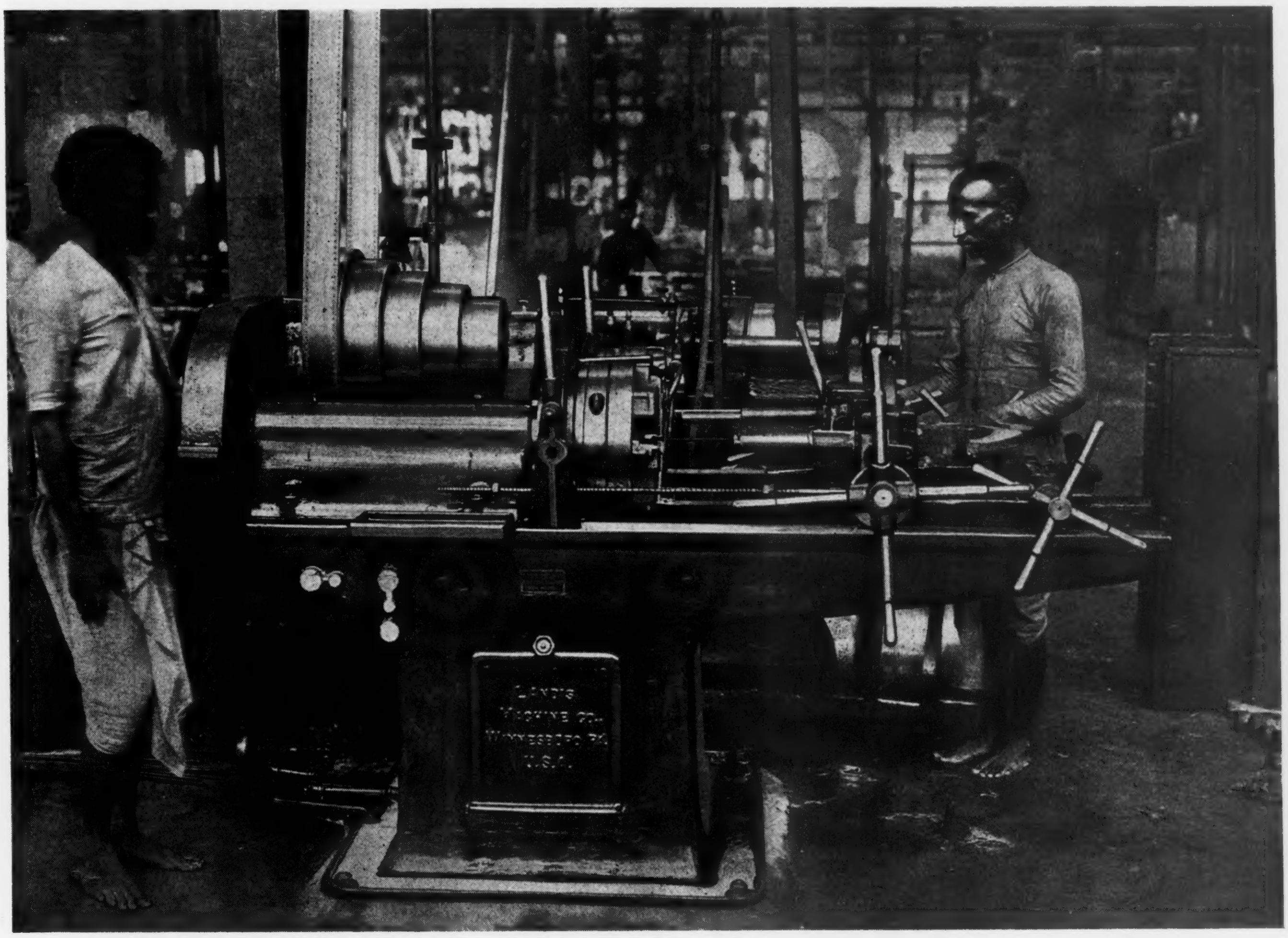
Let us explain in detail. Bulletin "Examples of Turning on the Manufacturing Lathe" covers this thoroughly. Shall we send you a copy?



18" Selective Head Manufacturing Lathe. Equipment includes connected, compound and plain rests, multiple length and diameter stops, pan pump and tubing, high duty and four way tool blocks. Made in sizes 14" to 30".

Machine Tool Co.

OHIO



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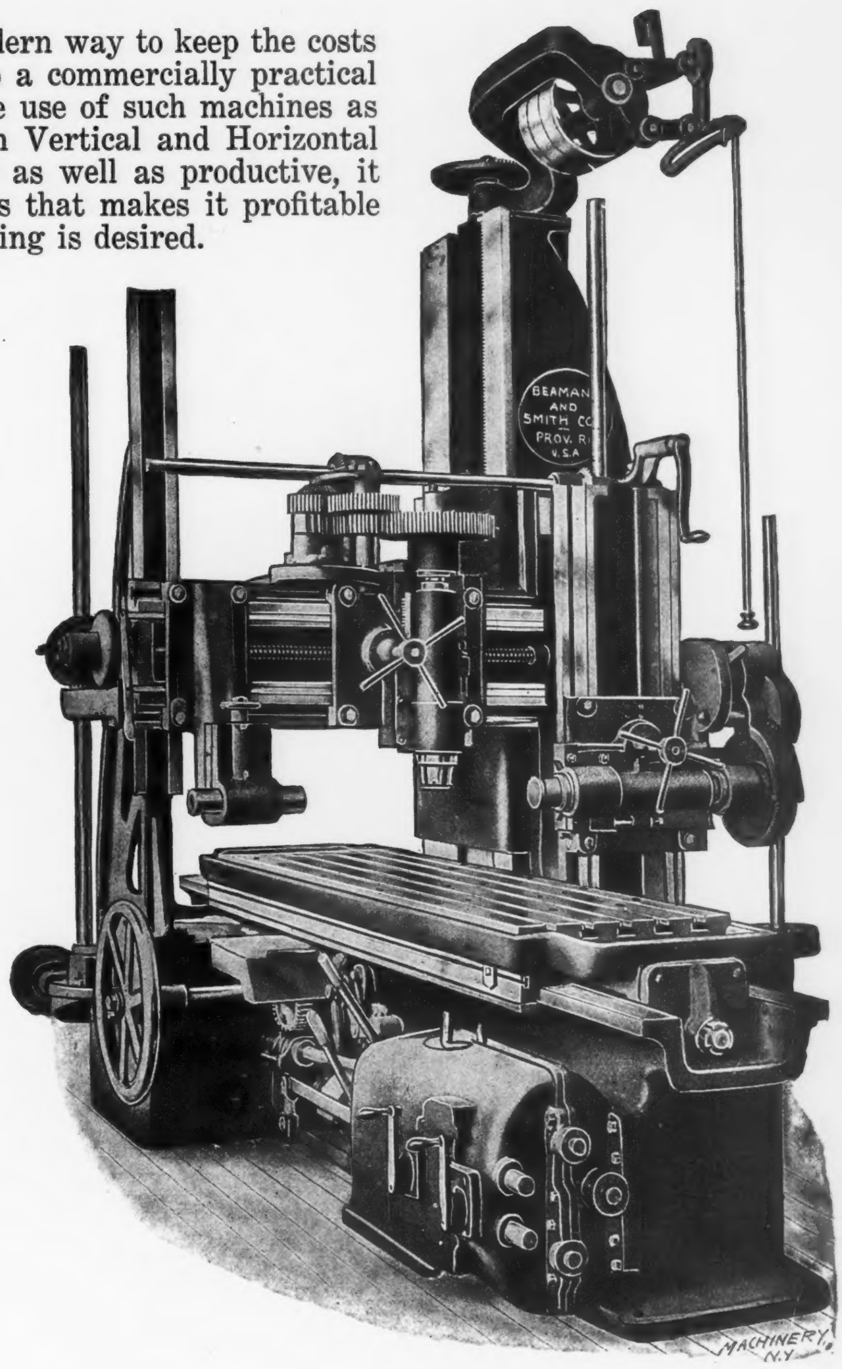
Production Machines for Milling, Drilling, Boring and Tapping

Quantity production—the modern way to keep the costs of high quality work down to a commercially practical level—is made possible by the use of such machines as this B.&S. No. 2 Combination Vertical and Horizontal Milling Machine. Adaptable as well as productive, it has a wide field of usefulness that makes it profitable wherever rapid, accurate milling is desired.



The table is 24″ by 8″ with 9″ movement on the bed; nine changes of automatic table speed with quick power movement of 15′ in either direction make it possible to maintain any desired rate between 7/8″ to 9½″ per minute at any spindle speed. Spindles can be driven in unison or singly, horizontal spindles can be driven in either direction. Double back gearing for each spindle attached to its respective head permits the simultaneous employment of different speeds.

Send for the circular of this machine or tell us your needs in this line and we'll send you details of the B. & S. machines most calculated to meet them.

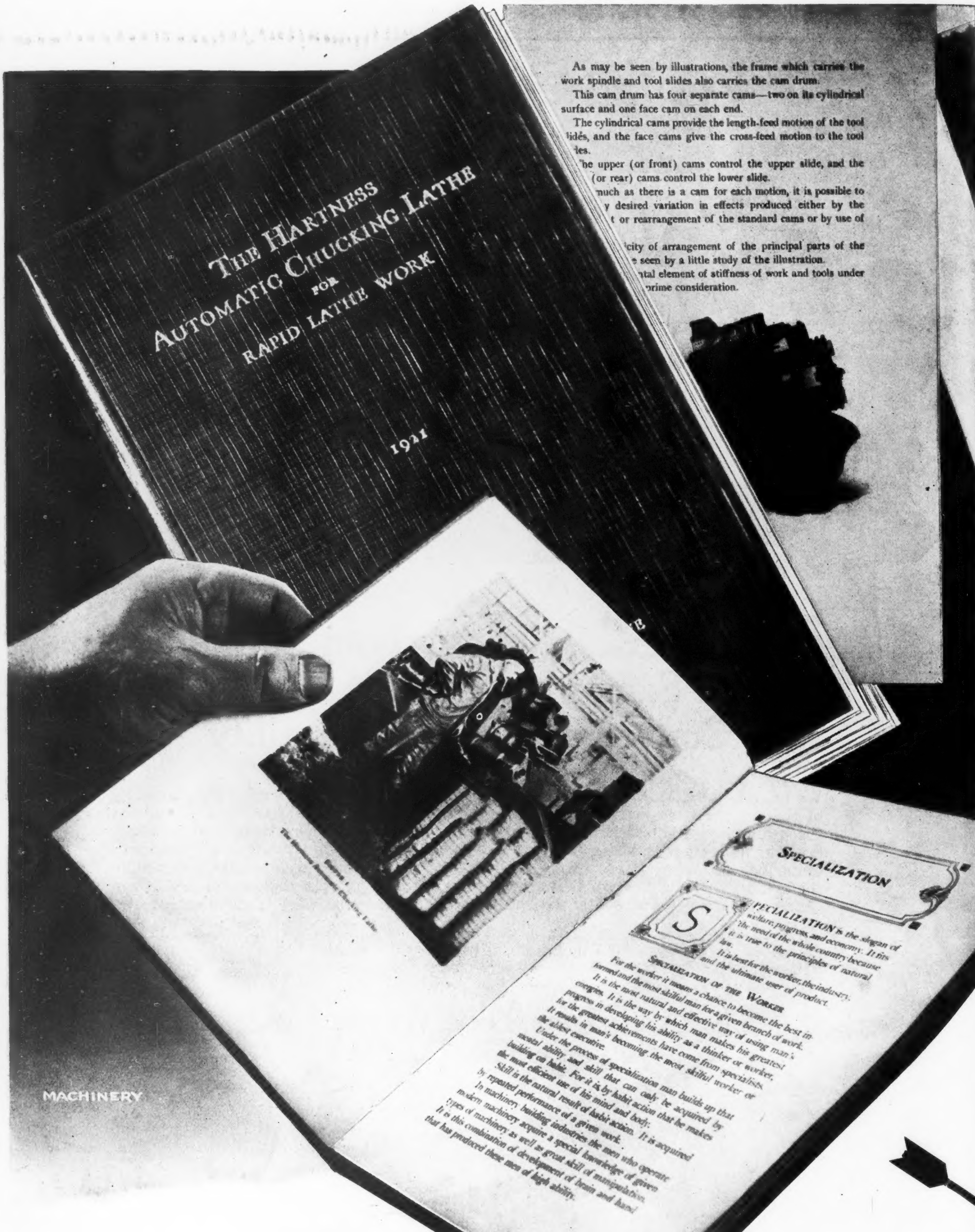
The Beaman & Smith Company

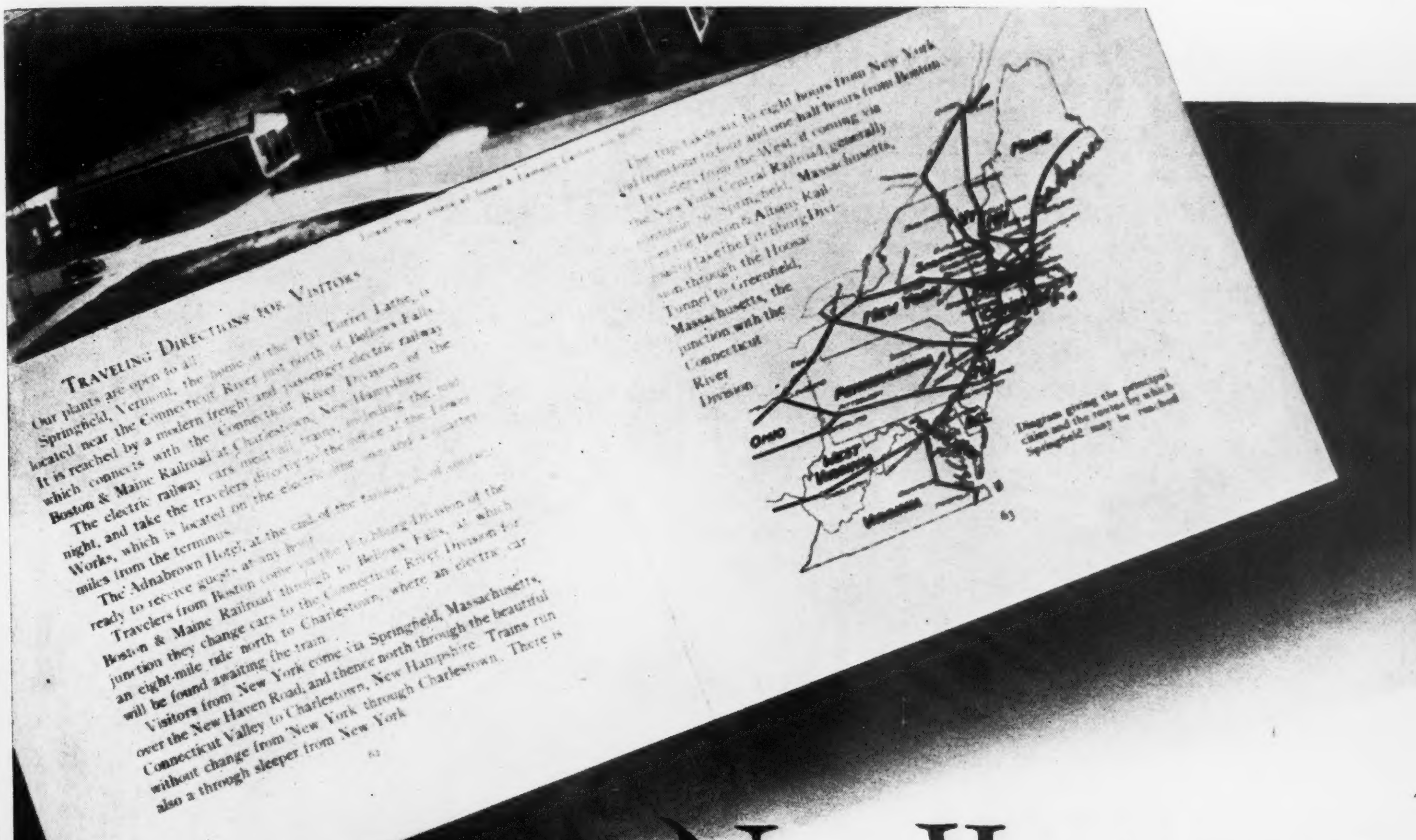
PROVIDENCE **RHODE ISLAND**

AMERICAN

After Ten Years Hard Service this Lathe is Still Admirably Adapted for the Difficult Work Shown Below—Turning Tool Steel Centers for Dividing Heads.

There are two "American" Tool-room Lathes in the Mill City Mfg. Co.'s plant, at Minneapolis, Minn.—one ten, the other eight years old—the satisfactory performances of the first having sold the second. Both are used for general shop work as well as for fine tooling and are as uniformly accurate as when first installed. The work shown is tool steel centers for dividing heads for "Kriesel" Machines—machined in pairs and then cut apart.


As may be seen by illustrations, the frame which carries the work spindle and tool slides also carries the cam drum.
This cam drum has four separate cams—two on its cylindrical surface and one face cam on each end.
The cylindrical cams provide the length-feed motion of the tool slides, and the face cams give the cross-feed motion to the tool
THE HARTNESS AUTOMATIC CHUCKING LATHE FOR RAPID LATHE WORK
1921
SPECIALIZATION
SPECIALIZATION OF THE WORKER
MACHINERY



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Fill in the coupon to make sure a copy of our latest catalogue is in your file. The book describes the New Lathe, illustrates its application to every day manufacturing needs—and points the way to economical production.

The new machine is designed to accommodate work up to 6" long and 12" diameter —the ultimate in simplicity, power and speed.

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503 Market St., San Francisco, Cal. F. Auberty & Co., 182 Rue Lafayette, Paris, France, Spain and Belgium. Holland: Spliethoff, Beeuwkes & Co., Leuvehaven Wz. 159, Rotterdam. Japan, Korea, etc., Mitsui & Co., Ltd., Tokyo. Australasia: McPherson's Pty. Ltd., 554 Collins St., Melbourne. Sweden: A. Bol. Oscar Lindbom, Stockholm.

Jones & Lamson Machine Co.
Springfield, Vt., U.S.A.

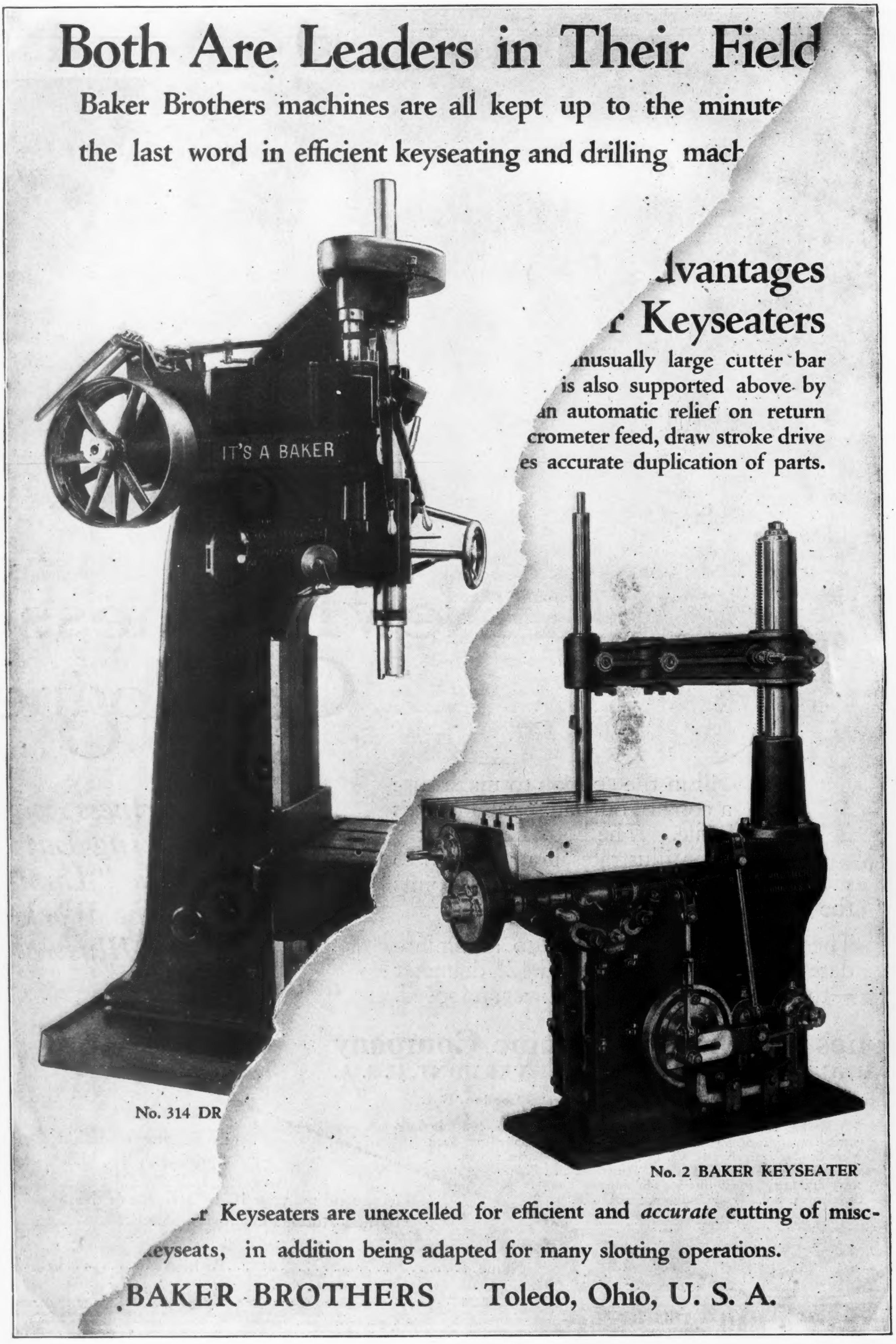
Please send me your 1921 Catalogue of the Hartness Automatic Chucking Lathe.

Name.................... ......Position ....

Address.............................Company ....

....

MAIL THIS COUPON TODAY


Both Are Leaders in Their Field
Baker Brothers machines are all kept up to the minute
the last word in efficient keyseating and drilling mach
dvantages
r Keyseaters
unusually large cutter bar
is also supported above by
an automatic relief on return
crometer feed, draw stroke drive
es accurate duplication of parts.
IT'S A BAKER
No. 314 DR
No. 2 BAKER KEYSEATER
r Keyseaters are unexcelled for efficient and accurate cutting of misc-
keyseats, in addition being adapted for many slotting operations.
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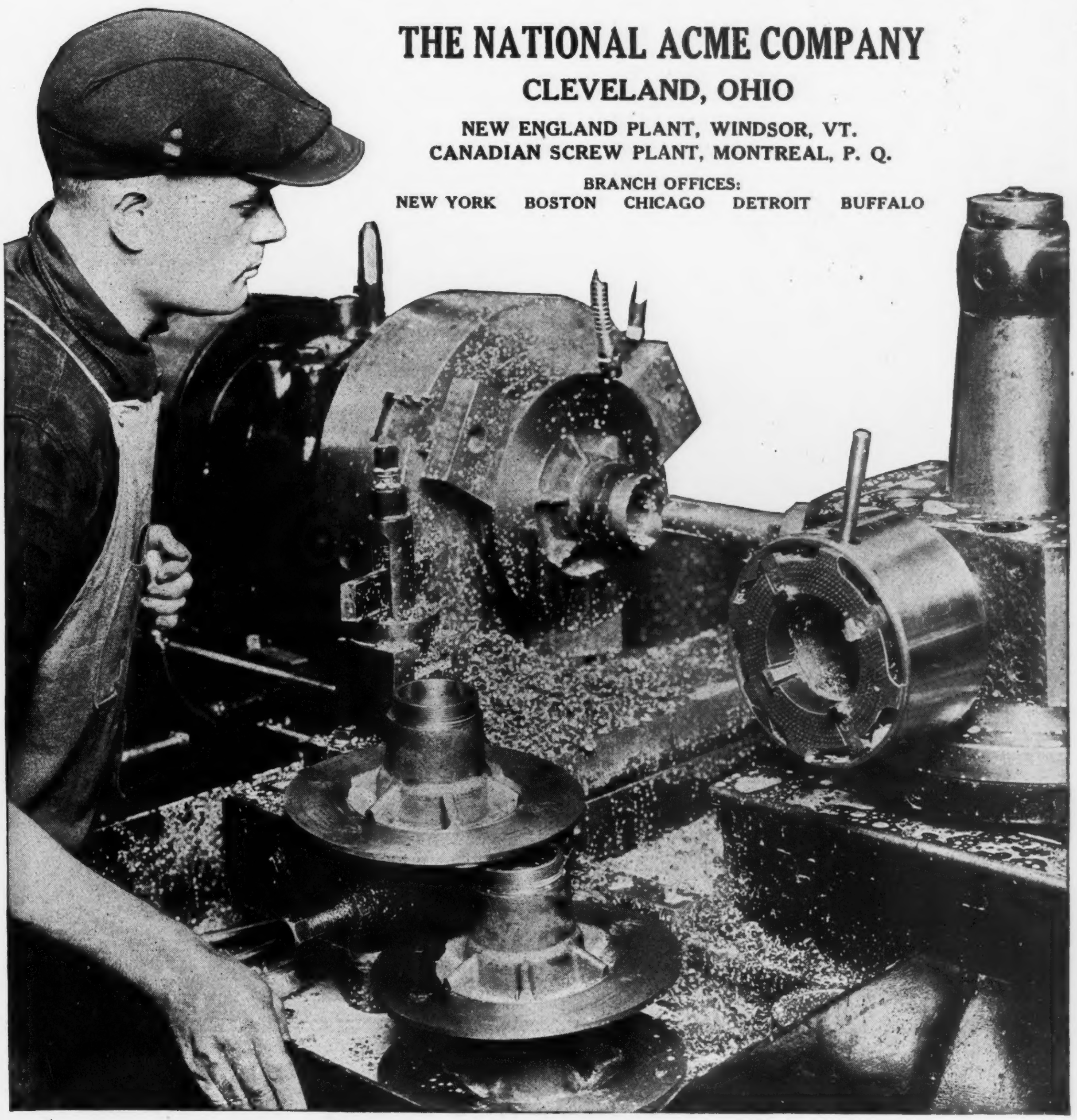
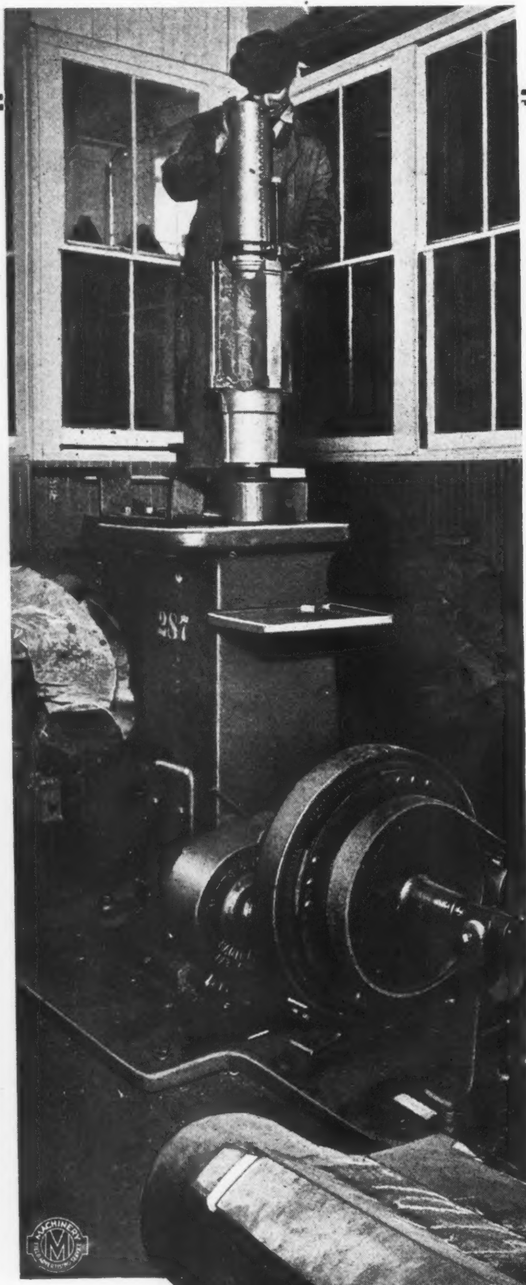




"GIANT" KEYSEATERS

"The Only Machine for this Work"

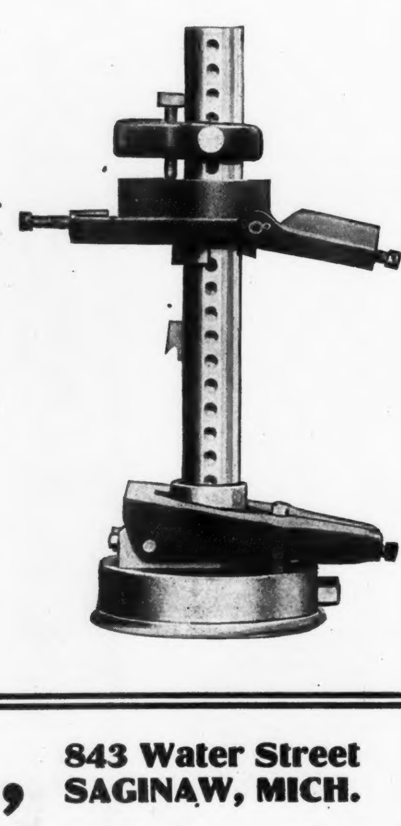
Says the Foreman

The Electro Dynamic Company, of Bayonne, N. J., is an enthusiastic user of **"GIANT"** Keyseaters, finding their speed and accuracy a useful combination in the cutting of keyways for motor parts.

The No. 6 A **"GIANT"** Keyseater shown is cutting a 1.250" wide by 7/16" deep by 15" long keyway in a cast-iron armature barrel. "It's the only machine for this work," says the foreman, "and a big improvement over our previous method of doing it." Floor to floor time per piece is 20 minutes. One of this concern's own 7½ H.P. electric motors is used to drive the **"GIANT"** Keyseater.

May we send you the catalog?

Cutting a Keyway 1.250" Wide, 7/16" Deep and 15" Long with a No. 6A "Giant" Keyseater. Floor to Floor Time 20 Minutes

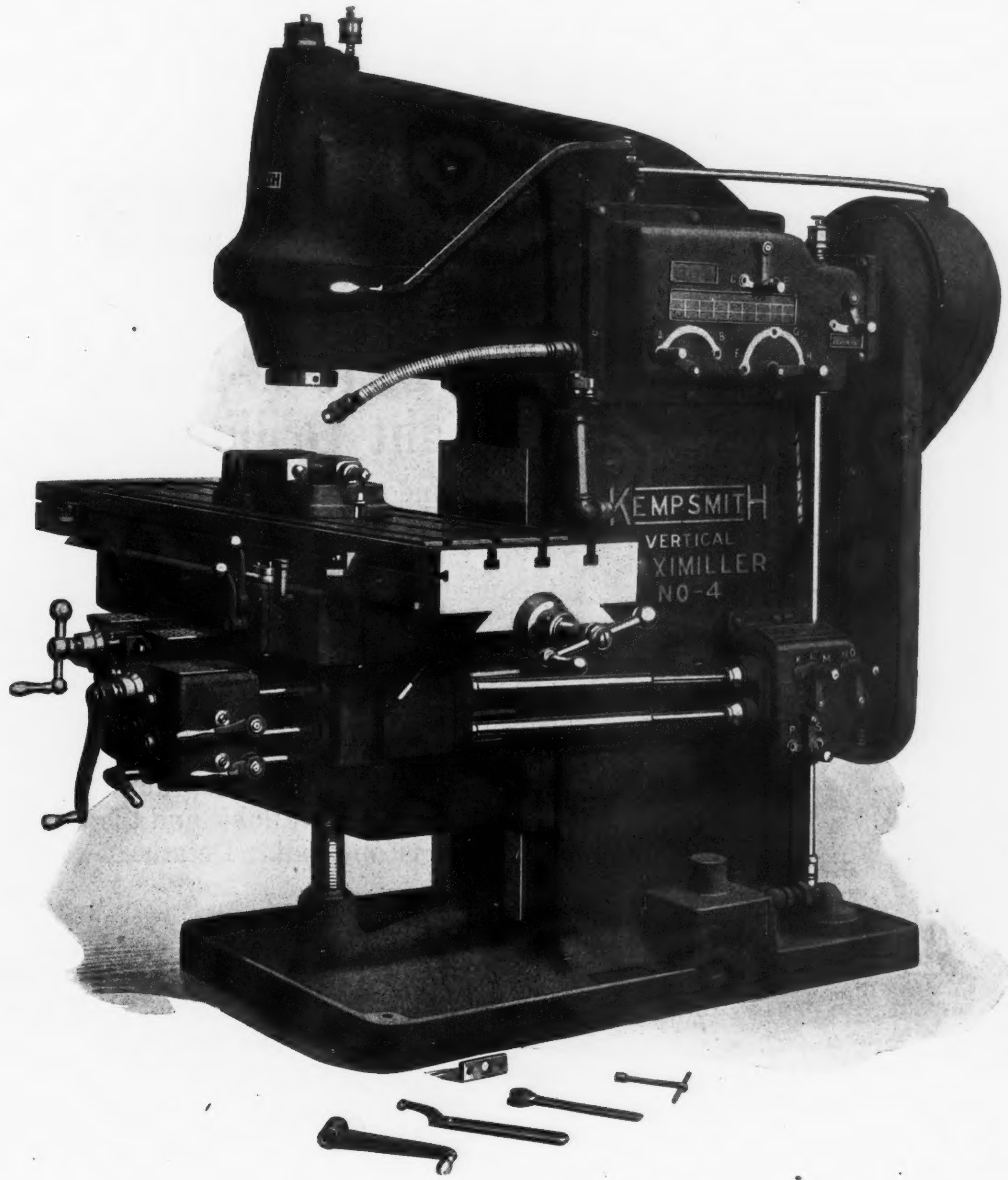


MITTS & MERRILL, 843 Water Street SAGINAW, MICH.

FOREIGN AGENTS: Burton, Griffiths & Co., London, England. Aux Forges de Vulcain, Lyons and Paris, France. V. Lowener, Christiania, Norway and Stockholm, Sweden.

KEMPSMITH MAXIMILLER

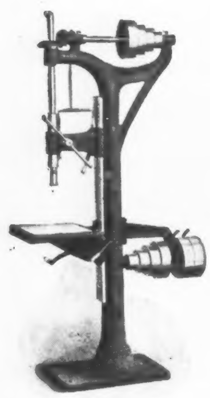
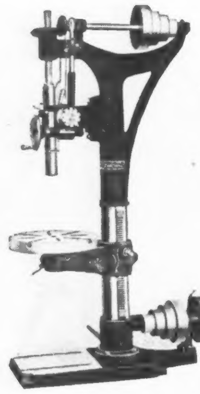
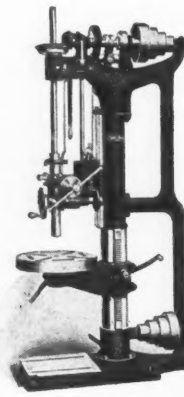
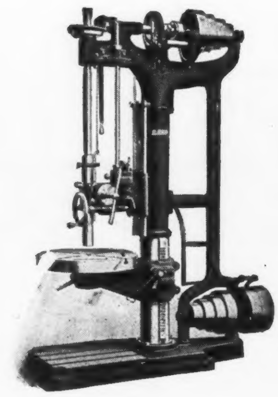
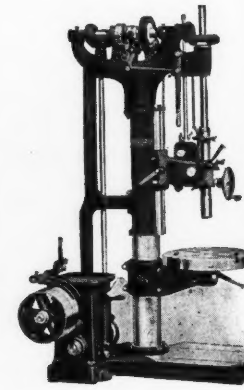
The No. 4 Vertical—A Machine of Unusual Merit

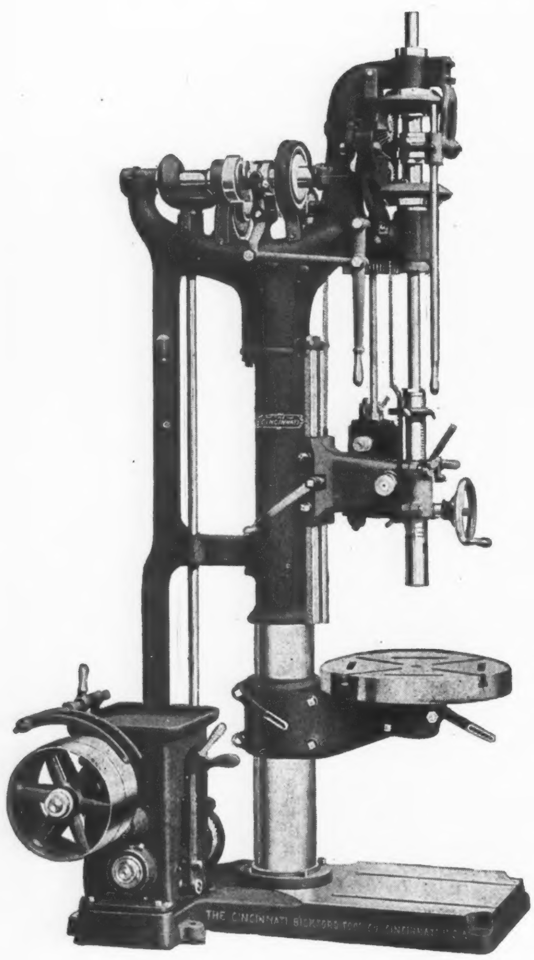


Ask Us For Circular No. 84 Which Gives Full Details.

KEMPSMITH MILWAUKEE, U.S.A.

FOREIGN AGENTS: American Trading Company, Tokyo, Japan. Barandiaran & Company, 3-Alameda, San Sebastian, Spain. Bevan & Edwards Pty. Ltd., 117 King Street, Melbourne, Australia. Blair, Reed & Company, Nathan's Building. Box No. 941 Wellington, New Zealand. Edgar Bloxham, 12 Rue Du Delta, Paris, France. Societe Anonyme Belge Alfred Herbert, 34 Rue Melsens, Brussels, Belgium. Nielsen & Winther, Blegdamsvej 60, Copenhagen, Denmark. Parke & Lacy Company, 60 Clarence Street, Sydney, N. S. W., Australia. Rene Berndes, Calle de Cuba, No. 61, Havana, Cuba. Selson Engr. Company, 85 Queen Victoria St., London, E. C., England. Selson Engr. Company, Corso Vittorio Emanuele, No. 11, No. 9, Turin, Italy. Selson Engr. Company, 5 Piazzo Castella, Milan, Italy. Forum Smidt & Cia., Peru Esquina, San Juan, U. T. 2704, Buen Orden, Buenos Aires, Argentina. Mr. Armando Busseti, Rua 7 de Setembro No. 183, 1° Rio de Janeiro, Brazil. Pascual Teja, 1 a Capuchinas, No. 32, Mexico, D. F. Spliethoff, Beeuwkes & Co., Leuvehaven, W. Z. 159 Rotterdam, Holland. Turner, Hoare & Company, Ltd., Gateway Bldg., Lansdowne Road, Apollo Bunder, Bombay, India. Charter & Gardiner, P. O. Box 1201, 55 Calle Echaque, Santa Cruz, Manila, Philippine Islands.



THE
CINCINNATI

The 24-in. to 42-in. High-Speed Upright Drilling Machine

Quality and convenience are developed far beyond the average in these high-speed, wide range machines. Back gears and tapping attachment operate through friction clutches which eliminate shock and noise and save time, power and upkeep. Any of 16 spindle speeds are instantly available and automatic trip and depth gage protect both tools and work and insure exact duplication on production jobs. A choice of three different tables and three styles of drive is available and the tapping attachment is optional. Details of whole line on request.

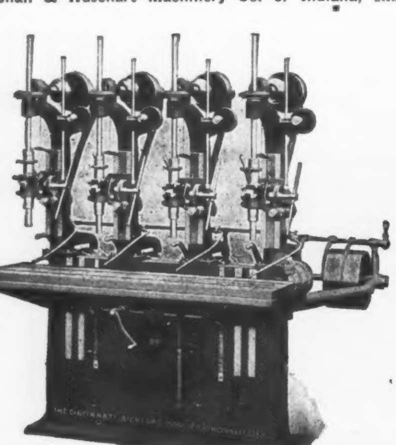
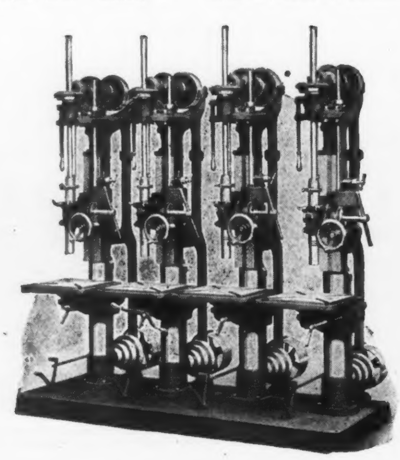
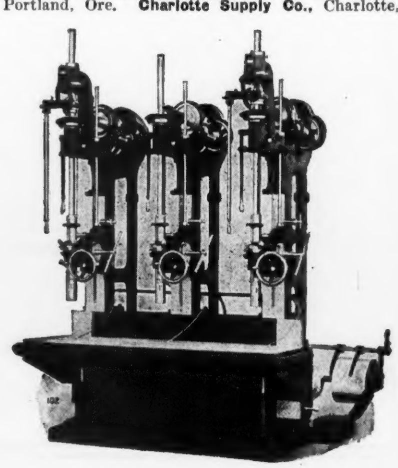
The Cincinnati-Bickford Tool Co.

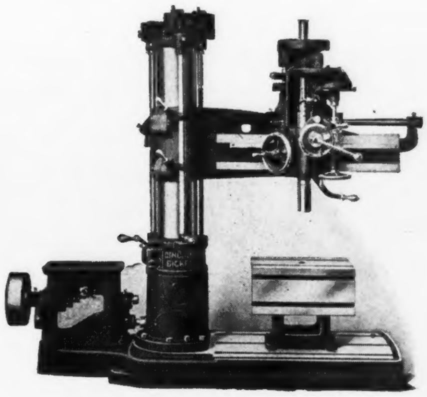
Oakley, Cincinnati, Ohio, U. S. A.

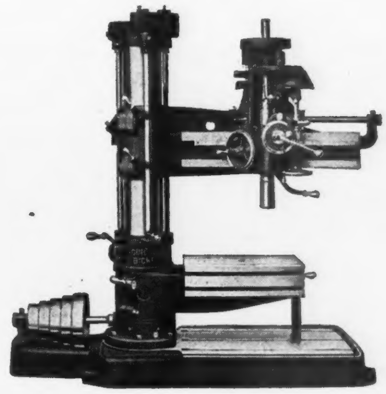
Founded 1874

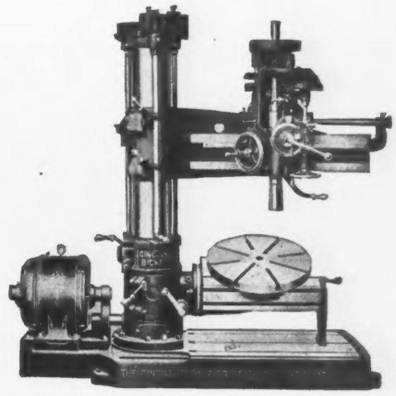
U581

DOMESTIC AGENTS: Henry Prentiss & Co., Inc., New York, Hartford, Conn.; Boston, Mass.; Buffalo, Rochester, and Syracuse, N. Y. **Motch & Merryweather Machinery Co.**, Cleveland, Ohio; Detroit, Mich.; Cincinnati, Ohio, and Columbus, Ohio. **Marshall & Huschart Machinery Co.**, Chicago, Ill. **Brown & Zortman Machinery Co.**, Pittsburgh, Pa. **W. E. Shipley Machinery Co**, Philadelphia, Pa **Marshall & Huschart Machinery Co. of Indiana**, Indianapolis, Ind. **Elliott & Stephens Machinery Co.**, St. Louis, Mo. **Harron, Rickard & McCone**, San Francisco, Calif., and Los Angeles, Calif. **C. T. Patterson Co., Ltd.**, New Orleans, La. **Robinson, Cary & Sands Co.**, St. Paul, Minn.. and Duluth, Minn. **Kemp Machinery Co.**, Baltimore, Md. **Dewstoe Machine Tool Co.**, Birmingham. Ala. **Seeger Machine Tool Co.**, Atlanta, Ga. **Hallidie Machinery Co.**, Seattle, Wash. **Zimmerman-Wells-Brown Co.** Portland, Ore. **Charlotte Supply Co.**, Charlotte,

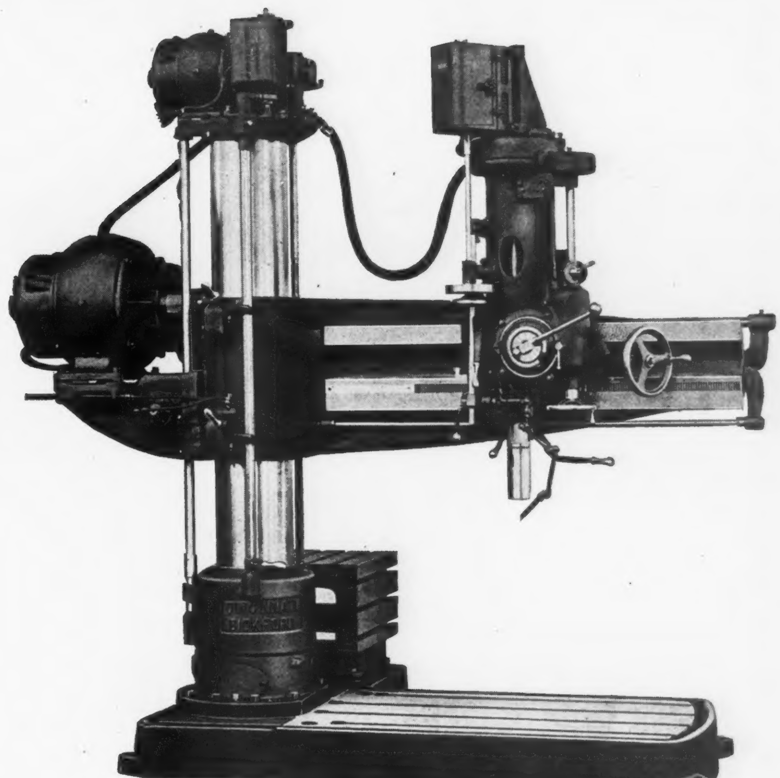






THE CINCINNATI BICKFORD

Electrically Driven Throughout—As Usual Cincinnati Bickford Leads



Operating this completely motorized C-B Radial is almost a case of "you push the button; we do the rest," and construction is appreciably simplified.

Four shafts and seven gears are eliminated by gearing a 3 to 1 variable speed motor direct to the arm shaft and mounting a constant speed reversing compound wound motor on the column.

As shown, the machine is further equipped with our compressed air column—binder and cutting lubricant outfit—their superior advantages fully described in our latest bulletin.

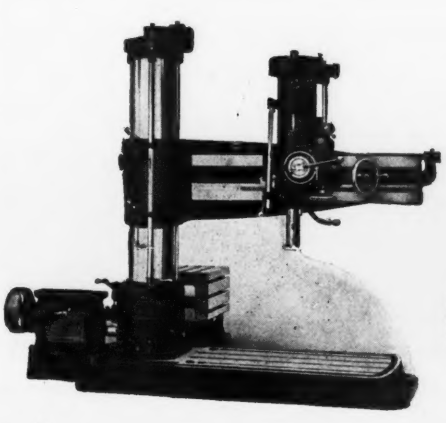
The Cincinnati Bickford Tool Co.

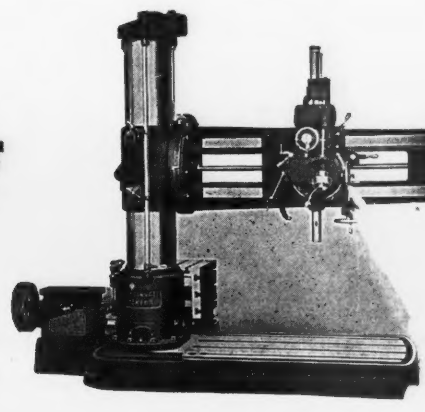
Oakley, Cincinnati, Ohio, U. S. A.

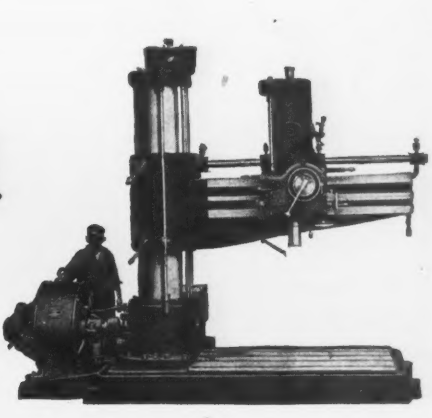
Founded 1874

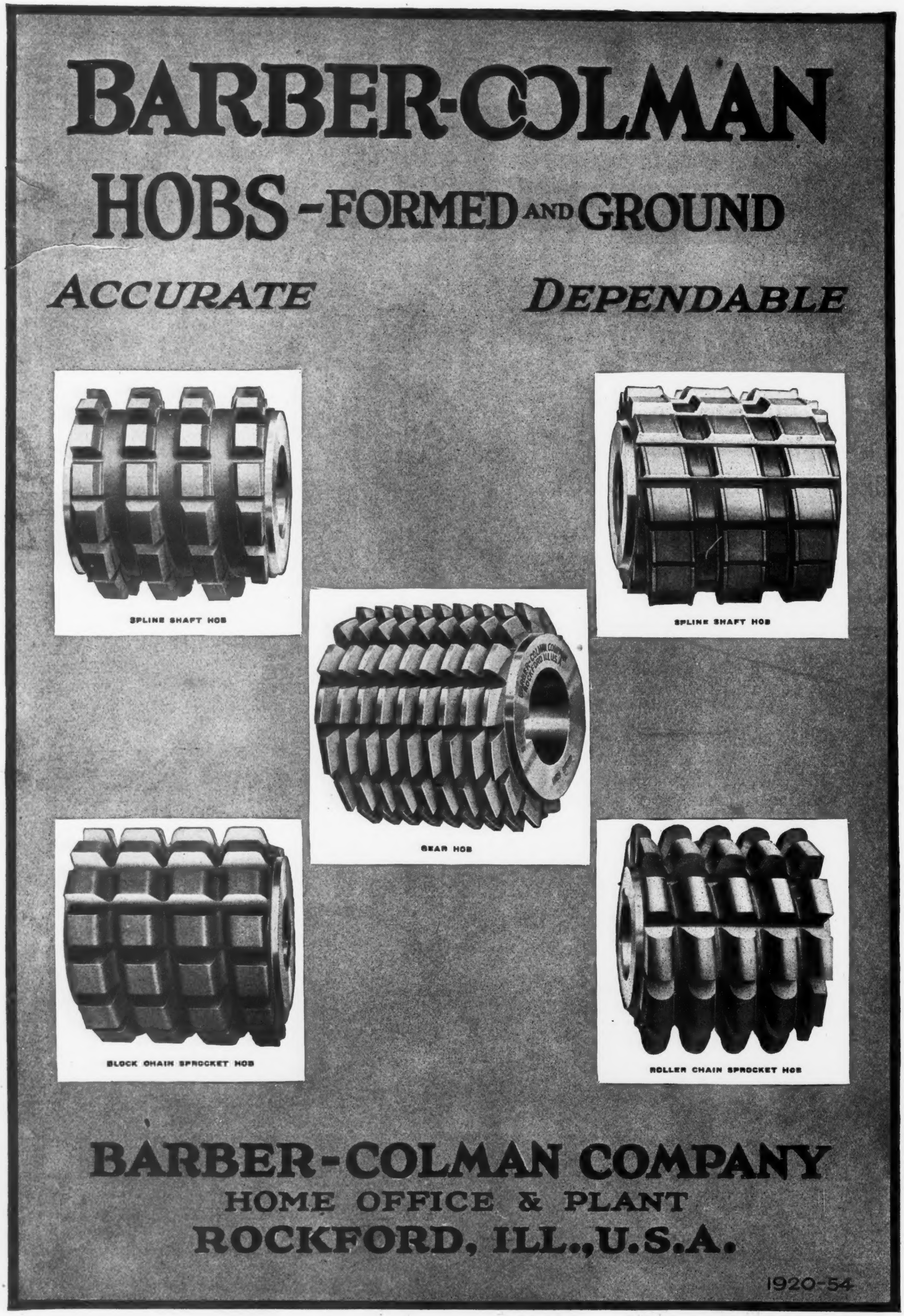
R581

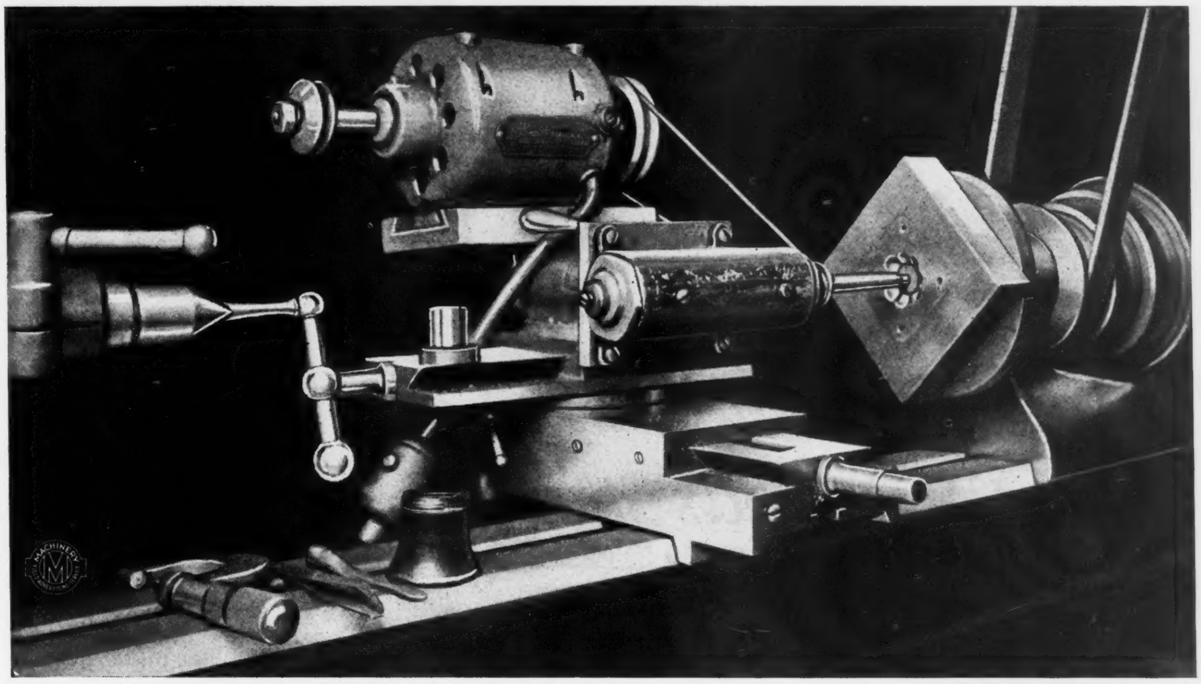
N. C. **Mills & Lupton Supply Co.**, Chattanooga, Tenn. **The Salt Lake Hardware Co.**, Salt Lake City, Utah. **CANADIAN AGENTS: H. W. Petrie, Ltd.**, Toronto, Ont. **Williams & Wilson, Ltd.**, Montreal, Quebec. **FOREIGN AGENTS: Charles Churchill & Co. Ltd.**, London, Manchester, Birmingham, Newcastle-on-Tyne, England, and Glascow, Scotland. **Aux Forges de Vulcain**, Paris, France. **Hijo de Miguel Mateu**, Barcelona, Spain. **Ateliers Demoor Ste Ame.**, Brussels, Belgium. **Chr. A. Herstad**, Copenhagen, Denmark and Stockholm, Sweden. **Andrews & George Co.**, Tokyo, Japan. **McPherson's Pty., Ltd.**, Melbourne, Australia. **Bartle & Co.**, Johannesburg, South Africa. **H. S. Gray Co.**, Honolulu, Hawaii. **Gustav Nielsen**, Christiania, Norway. **Maskin-Aktiebolaget E. Gronblom**, Abo, Finland. **J. Lambercier & Co.**, Geneva and Zurich, Switzerland. **Lovell Tool & Machine Co.**, Havana, Cuba. **Naamlooze Vennootschap Higeta**, Rotterdam, Holland. **Edward J. Nell & Co.**, Manila, P. I. **Phillip G. Roeder**, Mexico City, Mexico.








BARBER-COLMAN
HOBS - FORMED AND GROUND
ACCURATE
DEPENDABLE
SPLINE SHAFT HOB
SPLINE SHAFT HOB
GEAR HOB
BLOCK CHAIN SPROCKET HOB
ROLLER CHAIN SPROCKET HOB
BARBER-COLMAN COMPANY
HOME OFFICE & PLANT
ROCKFORD, ILL., U.S.A.
1920-54



Remarkable Adaptability Proved by this Unique Set-Up

This photograph, taken at A. Nacke & Sons, Philadelphia, Pa., shows a Dumore Grinder set-up for an internal grinding operation on a Rivett Bench Lathe. The internal grinding arm is removed from the grinder proper and screwed to a plate which is fastened to a shaft 1⅞" in diameter held in the tool holder; the driving mechanism is bolted to the other end of this shaft.

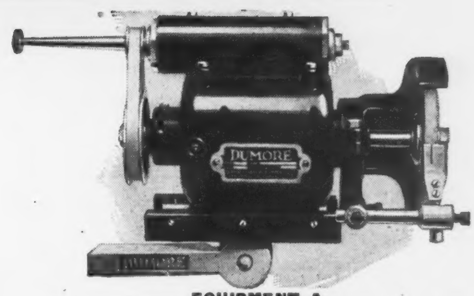
This unique set-up, necessary because of the construction of the Rivett Tool Holder, is made easily possible by the adaptability of this Dumore Grinder. A versatile machine, used in its original form on a large variety of work, it has saved the cost of a special grinding attachment for this machine and has done some exceedingly close work here in the past few years.

Although the set-up in this instance is unusual it is but another instance of the adaptability of Dumore Grinders. A part of their job is doing the unusual.

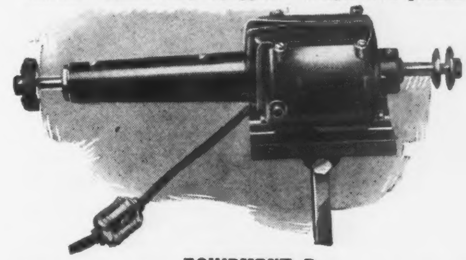
Send for a catalog of Dumore High-Speed Grinders and Drills
There is a model particularly suited to your work

Wisconsin Electric Company

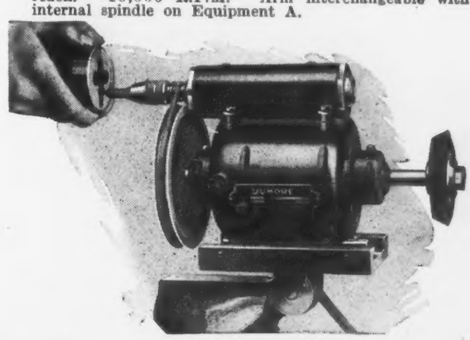
2538 Sixteenth Street **Racine, Wis., U.S.A.**



EQUIPMENT A
For general tool-room use. Includes High-Speed Internal Spindle A with reach of 3 inches. 30,000 R.P.M. Comes fully equipped. Weighs 171 pounds.



EQUIPMENT B
For deep internal work. Extension arm has 10-inch reach. 10,000 R.P.M. Arm interchangeable with internal spindle on Equipment A.



EQUIPMENT C
For button discs. Will grind 20 an hour. Interchangeable with A and B.

DUMORE HIGH SPEED GRINDERS

• INGER

Milling the Ends of 376 Connecting Rods per hour

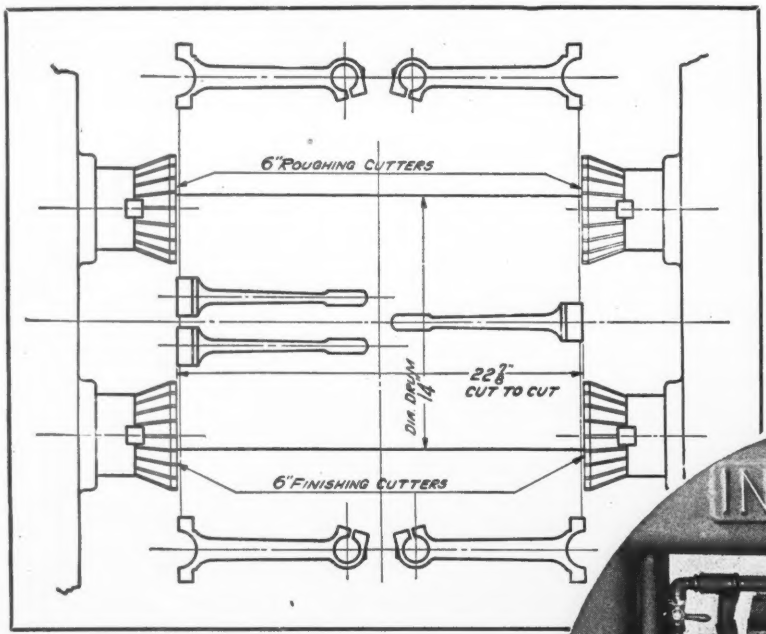
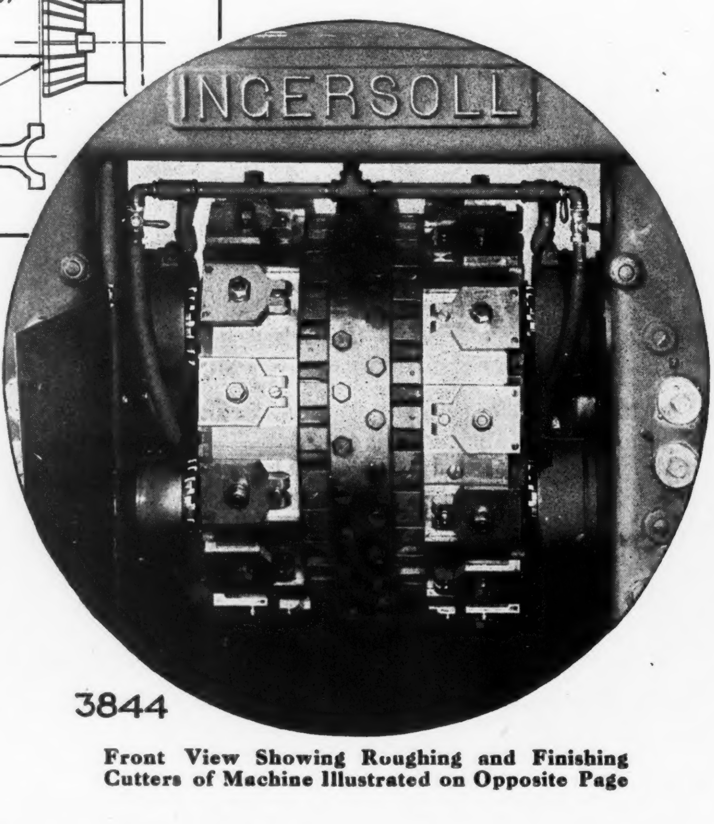


Diagram Showing Arrangement of Forgings on the Drum. The Fixture Holds 56 Forgings.

The diagram shows the continuity of machining that is made possible through Ingersoll Drum Type Milling Machines. Two circles of 28 forgings, each set so close together that they nearly touch, are continually revolving past the cutters. Both roughing and finishing cuts are taken on each rod at one setting. The forgings are held in a fixture quickly and easily operated by the operator. Each clamp holds a pair of forgings. The production is 376 pieces per hour.



Front View Showing Roughing and Finishing Cutters of Machine Illustrated on Opposite Page

On receipt of blueprints, we will gladly submit an estimate of guaranteed production.

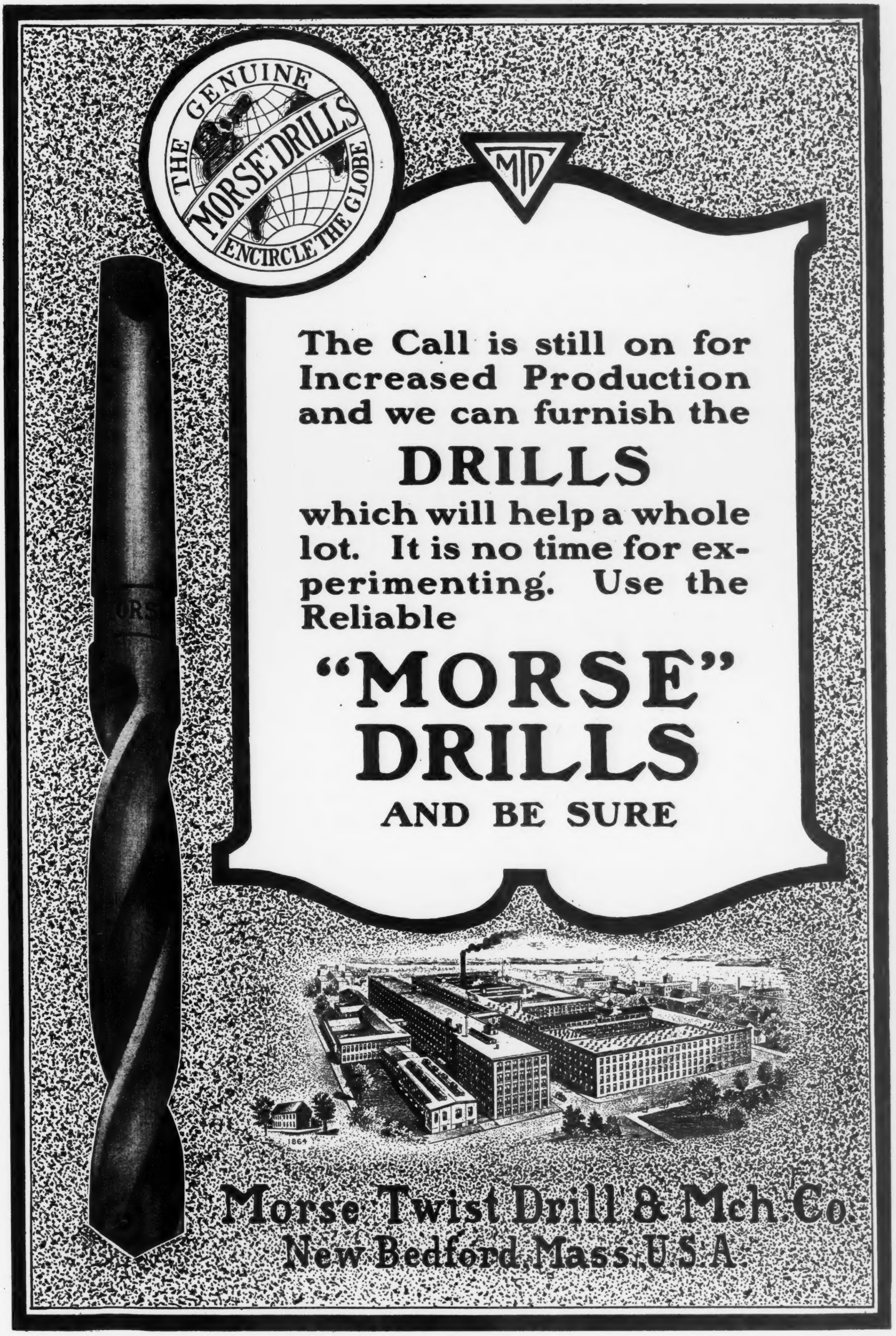
We design and build machinery for special work, and furnish fixtures and cutters complete for immediate operation when installed.

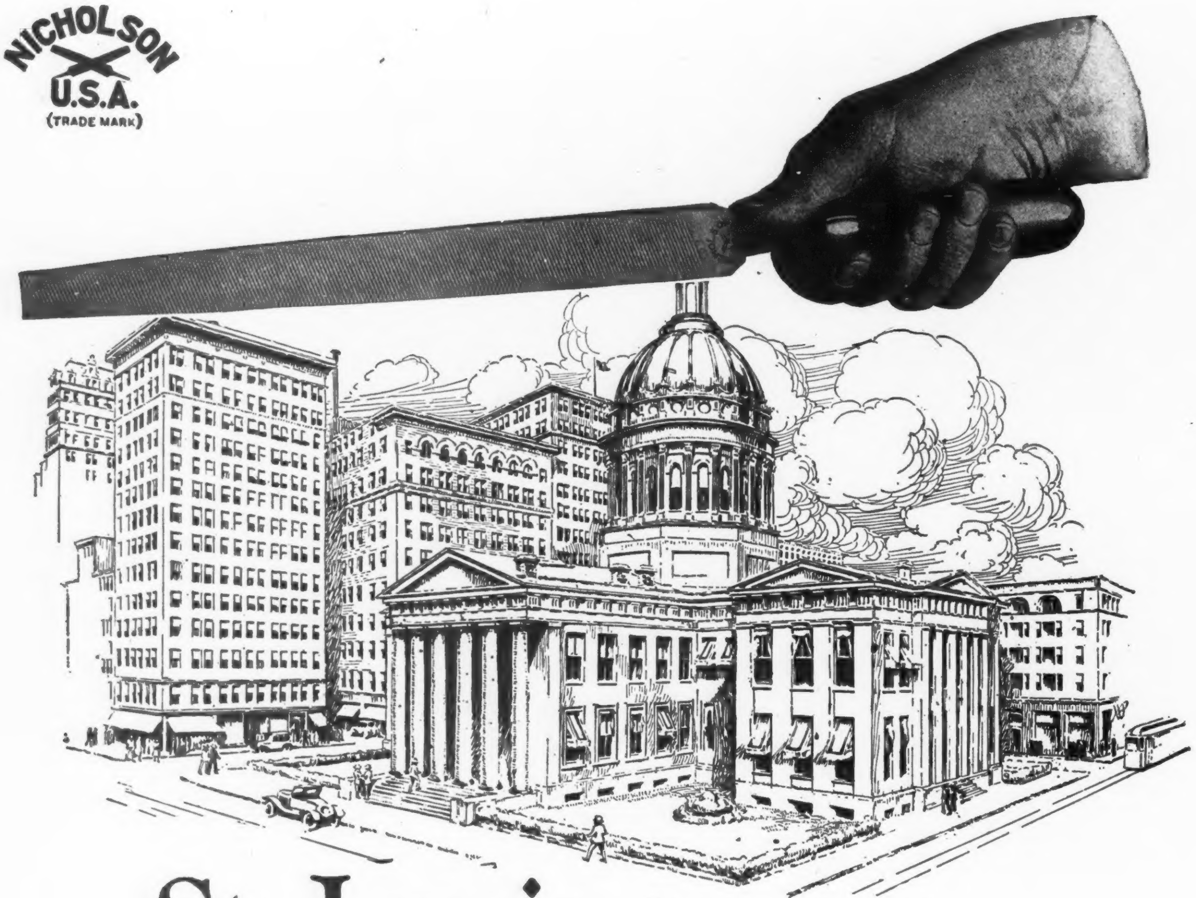
The Ingersoll Milling Machine Company

Milling Machines and Their Equipment

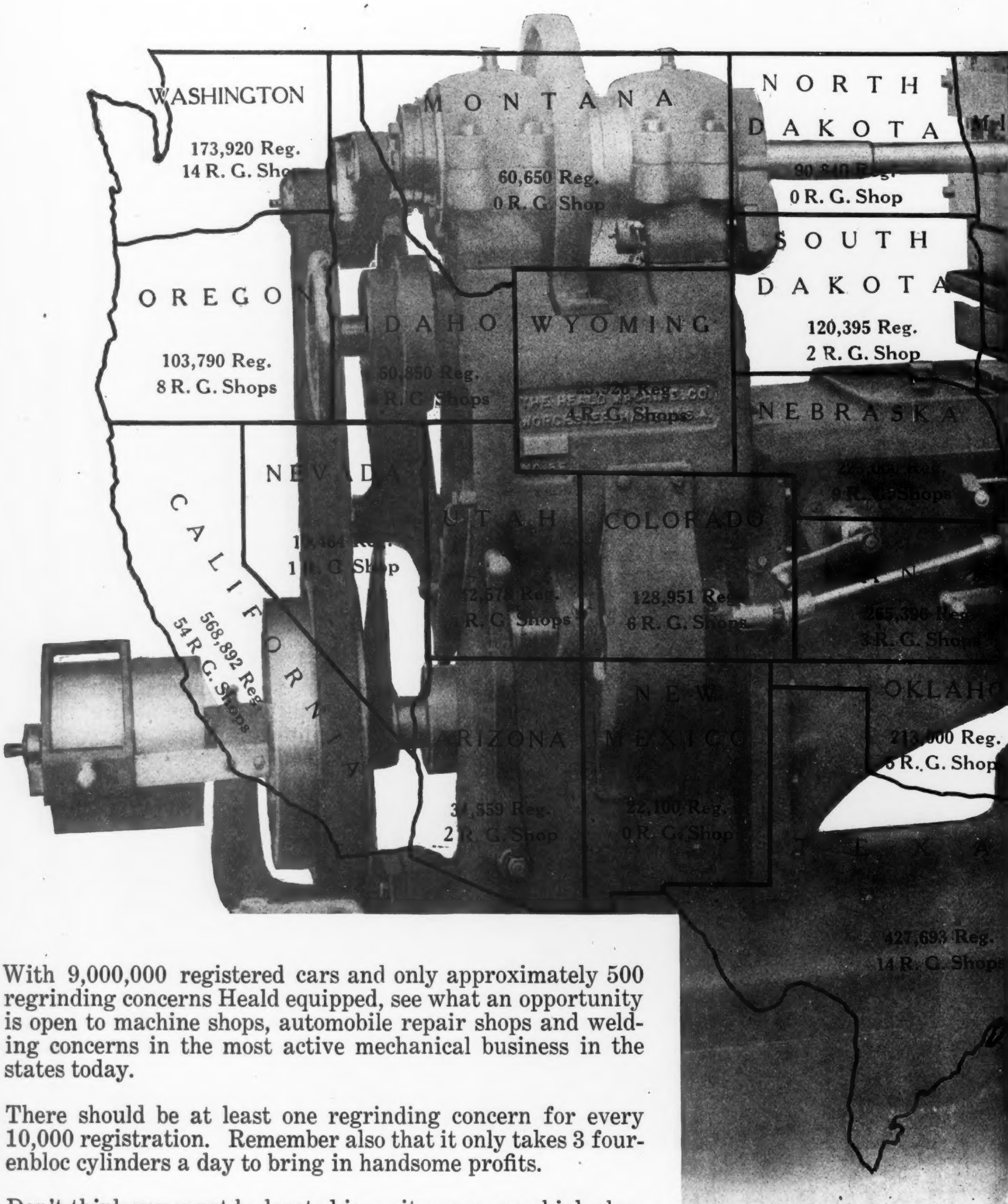
ROCKFORD, ILLINOIS

SALES OFFICES: 50 Church St., New York City. David Whitney Bldg., Detroit


THE GENUINE "MORSE" DRILLS ENCIRCLE THE GLOBE
MTD
The Call is still on for Increased Production and we can furnish the
DRILLS
which will help a whole lot. It is no time for experimenting. Use the Reliable
"MORSE" DRILLS
AND BE SURE
1864
Morse Twist Drill & Mch. Co.
New Bedford, Mass. U.S.A.



THE MAP OF



With 9,000,000 registered cars and only approximately 500 regrinding concerns Heald equipped, see what an opportunity is open to machine shops, automobile repair shops and welding concerns in the most active mechanical business in the states today.

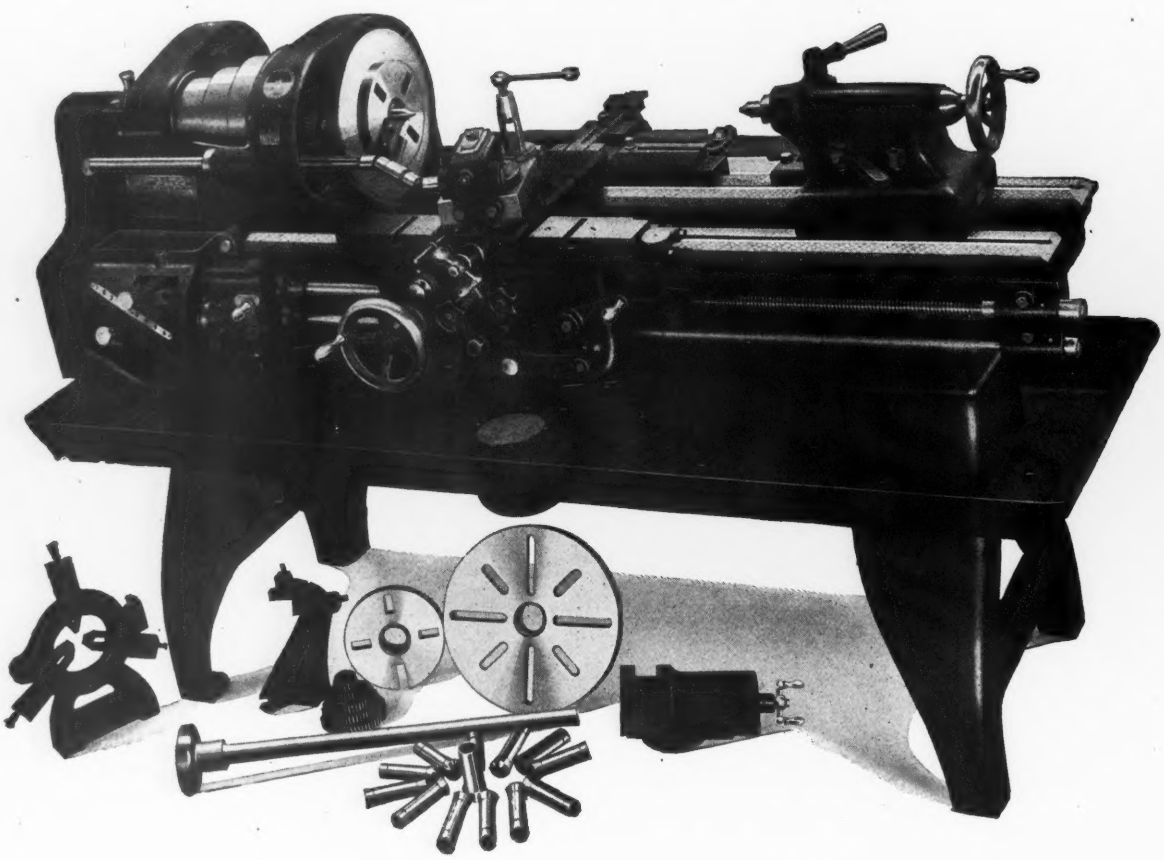
There should be at least one regrinding concern for every 10,000 registration. Remember also that it only takes 3 fourenbloc cylinders a day to bring in handsome profits.

Don't think you must be located in a city or among high class cars. 75% of the registrations are in towns and cities of less than 50,000 population and the largest profits are made on Fords and low-priced cars.

Write us in regard to your particular locality. We will give you facts and figures on the possibilities and profits. Remember, the first to start gets the cream. Better 'phone or wire. It will be a paying investment.

Monarch Tool-room Lathes

14"x6' Monarch Tool-room Lathe with full equipment, including *UNIVERSAL Relieving Attachment, Taper Attachment, Draw-in Attachment, Chasing Dial* and *Chasing Stop.*



Many other sizes of Monarch lathes can be furnished with complete tool-room equipment. Complete range of sizes 10-inch to 30-inch swing.

Special features of Monarch tool-room lathes include the following:

Full double plate apron with all drop-forged steel gears and central oiling system for back plate.

Efficient full Universal Relieving Attachment which is quickly attached and removed from the lathe.

Has all the features required for the rapid accurate making of tools and gauges.

Is constructed of the very finest materials and in sufficient quantity to justify the most modern methods of duplicate quantity production in their manufacture.

Monarch lathes are *manufactured* in quantity, not *built* singly or in small lots. As a consequence Monarch lathes are always attractively priced. Inspection records which are guarantees of accuracy accompany each lathe showing the accuracy of the lead screw for chasing and of the alignment of the lathe for accuracy in turning, facing and boring.

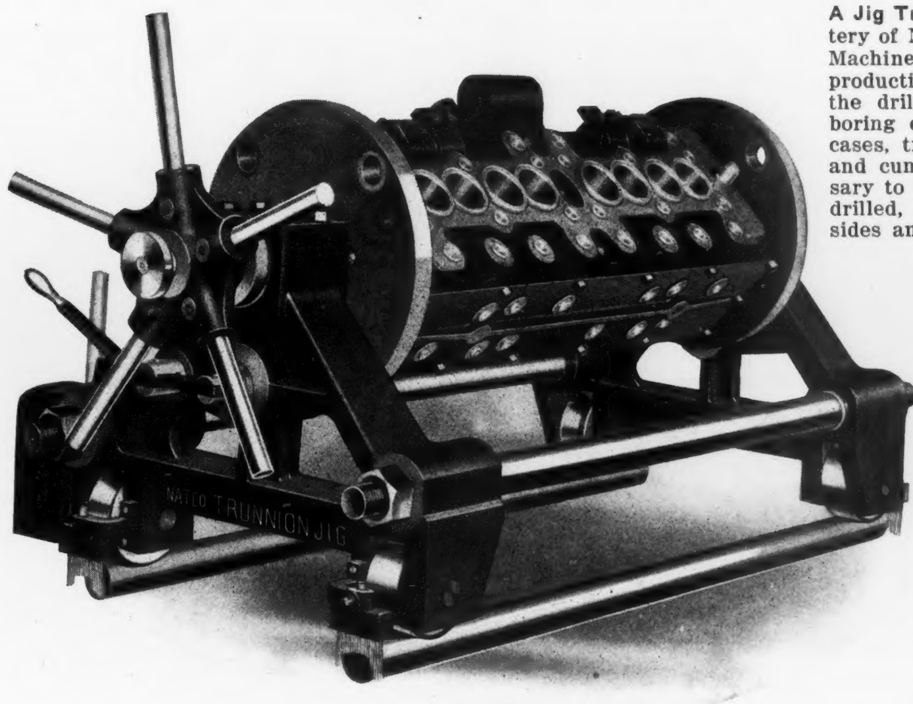
Few lathes equal and none rival the Monarch lathe for accuracy and efficiency.

The Monarch Machine Tool Co.

109 Oak St., Sidney, Ohio, U. S. A.

Lynd-Farquhar Co., Boston, Mass.; Brownell Machinery Co., Providence, R. I.; Purinton & Smith, Hartford, Conn.; Vandyck Churchill Co., New York, N. Y.; Syracuse Supply Co., Syracuse, N. Y.; Syracuse Supply Co., Buffalo, N. Y.; Syracuse Supply Co., Rochester, N. Y.; Simmons Machine Co., Albany, N. Y.; Morris Machinery Co., Newark, N. J.; Monarch Machinery Co., Philadelphia, Pa.; J. S. Miller Machinery Co., Pittsburgh, Pa.; Banks Supply Co., Huntington, W. Va., Greenboro Supply Co., Greensboro, N. C.; John P. Dale Machinery Co., Nashville, Tenn.; Oliver H. Van Horn Co., New Orleans, La.; Cameron & Barkley Co., Jacksonville, Fla., and Charleston, S. C.; Walraven Co., Atlanta, Ga.; Hartfelder-Garbutt Co., Savannah, Ga.; W. M. Pattison Supply Co., Cleveland, Ohio; The National Supply Co., Toledo, Ohio; Hallidie Machinery Co., Seattle, Wash.; Herberts Machinery & Supply Co., Los Angeles, Calif.; Herberts Machinery & Supply Co., San Francisco, Calif.; Reed & Duecker, Memphis, Tenn.; Peden Iron & Steel Co., Houston, Texas; Osborne & Sexton Machinery Co., Columbus, O.; Vonnegut Machinery Co., Indianapolis, Ind.; Charles A. Strelinger Co., Detroit, Mich.; McMullen Machinery Co., Grand Rapids, Mich.; Badger-Packard Machinery Co., Milwaukee, Wis.; Northern Machinery Co., Minneapolis, Minn.; Colcord-Wright Machinery & Supply Co., St. Louis, Mo.; English Tool & Supply Co., Kansas City, Mo.; Sunderland Machinery & Supply Co., Omaha, Nebr.; Hendrie & Bolthoff Mfg. & Supply Co., Denver, Colo.; Salt Lake Hardware Co., Salt Lake City, Utah; General Machinery Co., Spokane, Wash.; Portland Machinery Co., Portland, Oregon; Smith-Courtney Co., Richmond, Va.; E. L. Essley Machinery Co., Chicago, Ill.; The Murray Co., Dallas, Texas; Charles A. Strelinger Co., Windsor, Ont., Canada; V. Lowener, Denmark, Finland, Norway and Sweden.

Increase your production by use of NATCO Jigs and Fixtures in connection with NATCO Multi-Drillers and Multi-Tappers



Trunnion Jig made by NATCO, *used in plant of Midwest Engine Co., Indianapolis, Ind.*

A Jig Track System in connection with a battery of NATCO Multiple-Drilling and Tapping Machines enables the user to get the maximum production with the minimum man-power on the drilling, reaming, tapping and counterboring operations on cylinder heads, crankcases, tractor frames and all kinds of large and cumbersome parts in which it is necessary to place a number of accurately located drilled, reamed or tapped holes on various sides and angles.

An Indexing Trunnion Fixture is constructed to contain the part to be drilled. This fixture is designed to index to the necessary drilling positions on the various sides of the part to be drilled and spring-actuated shot-bolts securely hold the fixture in the desired position.

When the fixture is to be indexed to the next position it is only necessary to pull a lever and the shot-bolts are removed and the fixture is then indexed by means of either a pilot wheel or a handwheel.

On fixtures that are of such size and design as to be easily balanced a pilot wheel is used for indexing. When the fixture is of unusual size or weight, however, a worm and worm wheel indexing device is recommended which is operated by means of a handwheel.

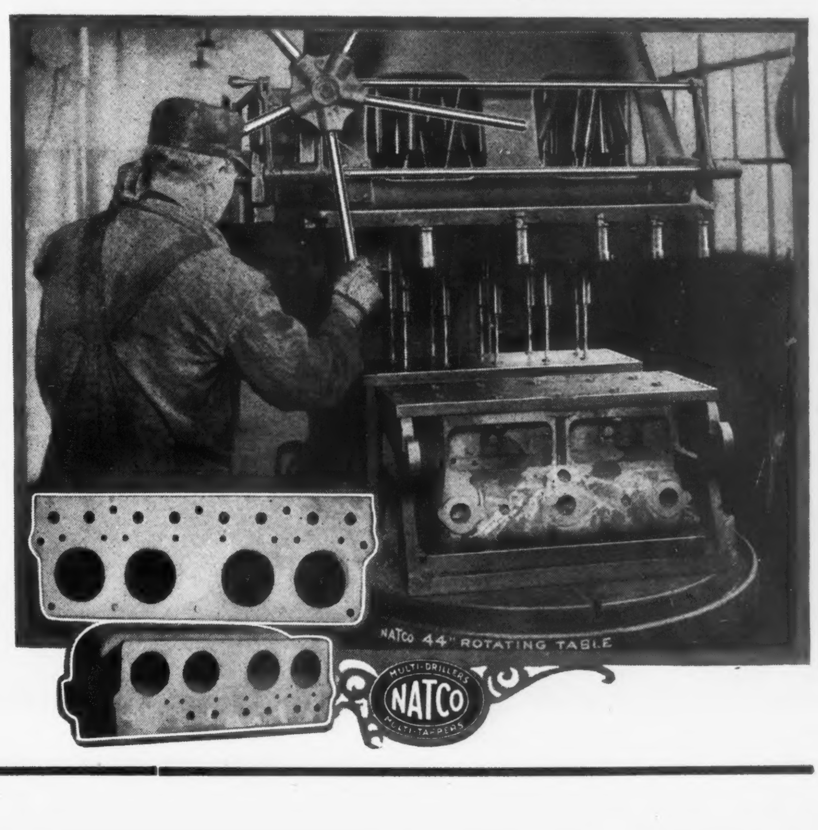
The Wheels on which the fixture is rolled along the track are of hardened steel and equipped with either roller or ball bearings. The wheels on one side of the fixture are generally made V-type for keeping the fixture in correct alignment with the machines, and the wheels on the opposite side of the fixture are flat. In some cases all four wheels are made V-type.

The use of NATCO Rotating Tables in connection with multiple spindle drilling machines is a NATCO development which offers great possibilities for increased production in drilling, reaming, tapping, spotfacing and counterboring. NATCO Jigs and Fixtures used in connection with Rotating Table makes it possible for the operator at all times to be engaged and the machine is never idle with the exception of a few seconds required to index the table.

The Rotating Table is particularly advantageous for drilling, for drilling and reaming for drilling, reaming, spotfacing, or counterboring and for obtaining close centers, which is made possible by passing the piece from one position to another without rejigging. The Rotating Tables are regularly indexed for 90°, 120°, and 180°, which permits one, two or three distinct operations to be performed at the same time.

NATCO Jigs and Fixtures are designed and built by men of years' experience in this line of work, and backed up by NATCO service should appeal to any manufacturer looking for the best possible design and construction in Jigs and Fixtures.

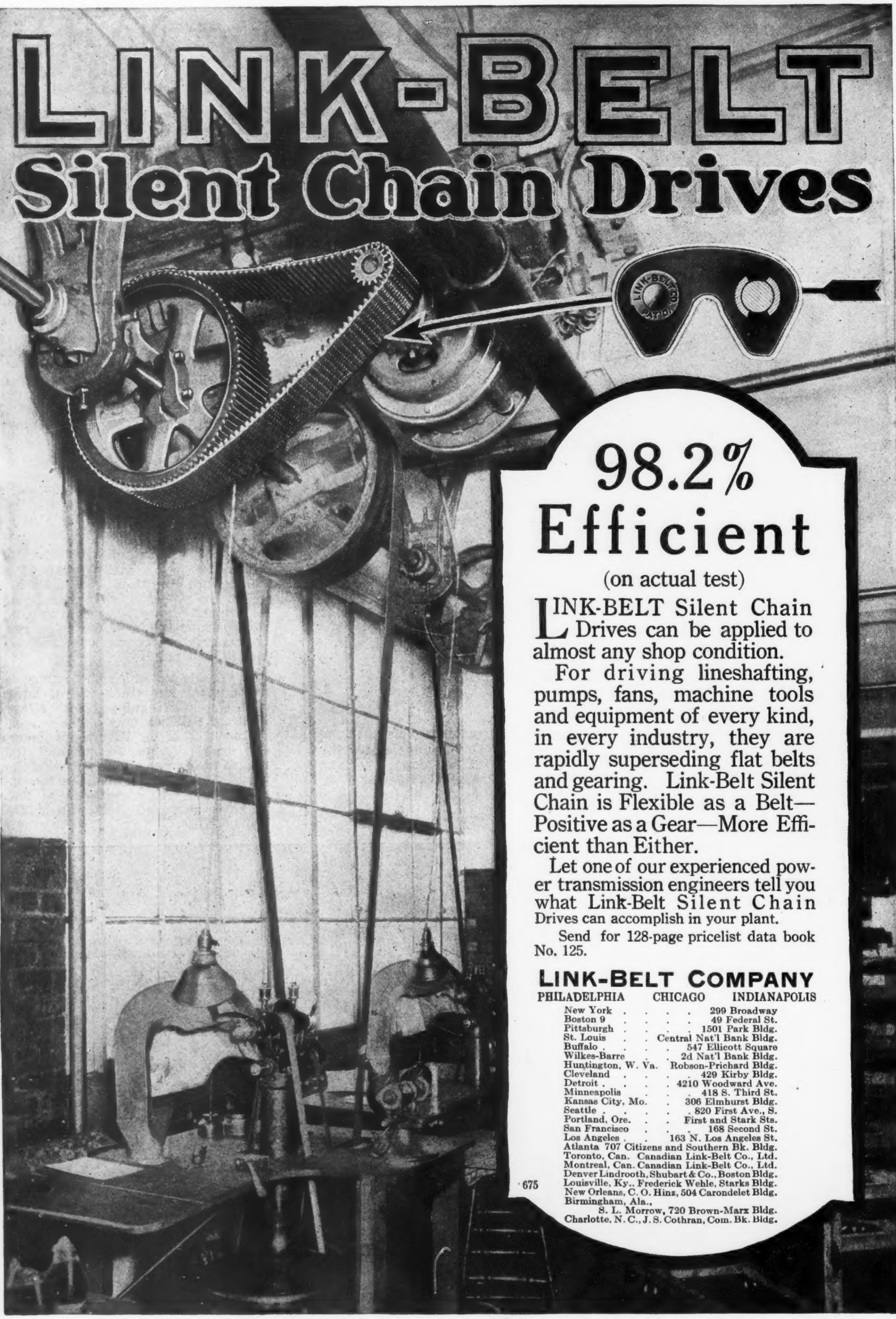
SEND US YOUR BLUE PRINTS, and we shall be glad to submit propositions for your approval, or write us and we will have NATCO representative call and make a study of your drilling requirements without any obligation on your part.



The National Automatic Tool Company

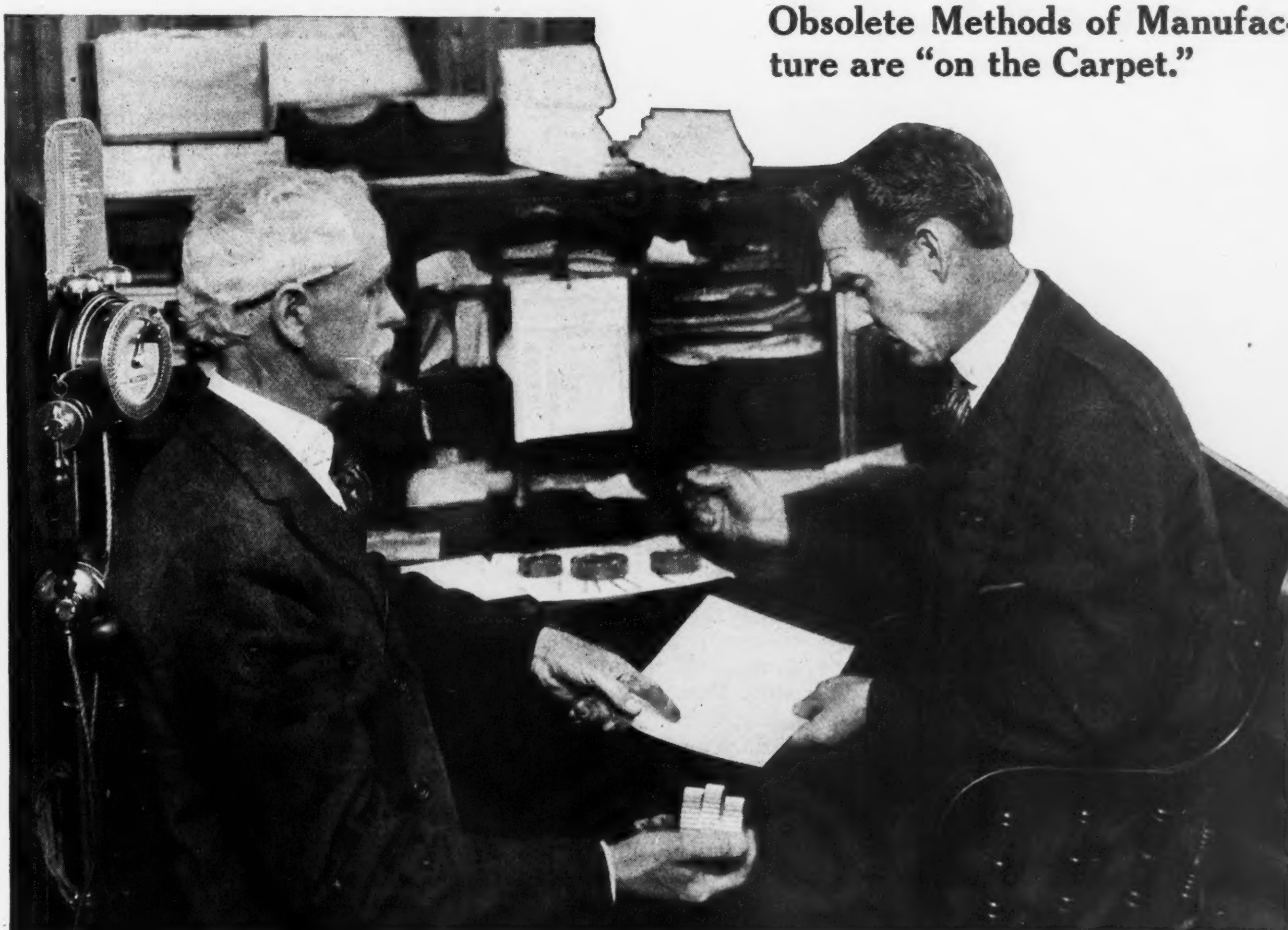
Largest exclusive manufacturers of Multi-Drillers and Multi-Tappers.

Richmond, Indiana, U.S.A.



F.G.S.Co. **SERVICE, ACCURACY, PRODUCTION** F.G.S.Co.

THE SURVIVAL OF THE FITTEST



Obsolete Methods of Manufacture are "on the Carpet."

HE is the production manager, and "he is on the carpet."

The cost superintendent is showing him last month's cost records on a certain type of gear. The conversation that ensues is somewhat as follows:

Cost Superintendent—"We must cut down the cost of these gears. They are mounting every month, whereas on other parts a reduction is shown or else we are breaking even."

Production Manager—"Well, what would you suggest? We have been making these gears in this way for years, and while we have had our troubles with repairs, etc., a better solution has not presented itself."

Cost Superintendent—"Well, what about making this gear in one piece, *instead of from three pieces riveted together?*"

Production Manager—***"If we do, how will we cut the teeth in the two end gears?"***

Cost Superintendent—"Why, haven't you read the Fellows Gear Shaper advertisements; they claim that the Gear Shaper will cut cluster gears when the clearance is 1/8 inch or more."

This is not the only Production Manager that is in trouble, and this is not the only type of gear on which the Gear Shaper will show a saving over any other known method. The Gear Shaper not only cuts gears more accurately, but produces them in larger quantities and at greatly reduced costs.

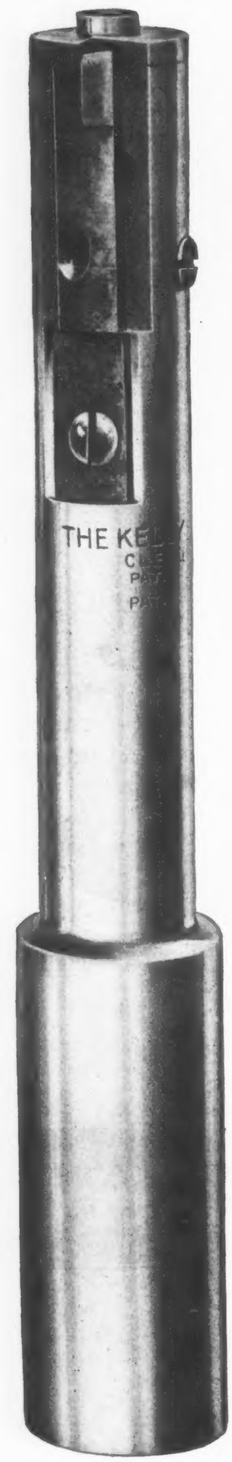
If you have any gear problems, why not write our engineering department? The suggestions you get may be the means of saving you considerable trouble and money. This service is yours for the asking, and has no strings tied to it.

The Fellows Gear Shaper Company

Springfield, Vermont, U. S. A.

Foreign Agents: Alfred Herbert, Ltd., Coventry, England; Societe Anonyme Alfred Herbert, Paris, France; Societa Anonima Italiana Alfred Herbert, Milan, Italy; Alfred Herbert, Ltd., Yokohama, Japan; Societe Anonyme Alfred Herbert, Barcelona, Spain; Societe Anonyme Belge Alfred Herbert, Brussels, Belgium; Alfred Herbert (India) Ltd., Head Office, Calcutta, India.

ACCURACY with SPEED



Modern methods of production demand that every operation be done speedily, but with the greatest accuracy. If you do not get these results, you are not getting the proper returns from your machine tools.

In the great industries of this country, where modern productive methods have been evolved, Kelly Tools have built themselves a reputation for these two qualities. They are designed to get the best results out of each operation and they obtain accuracy with speed because they fit the job.

However, each tool, whether standard or of special design, is made up of a number of standardized units; which means, quick delivery on replacements, interchangeability and low up-keep.

These qualities make Kelly Tools a good buying proposition anytime, but especially now.

THE KELLY REAMER CO., Cleveland, O.

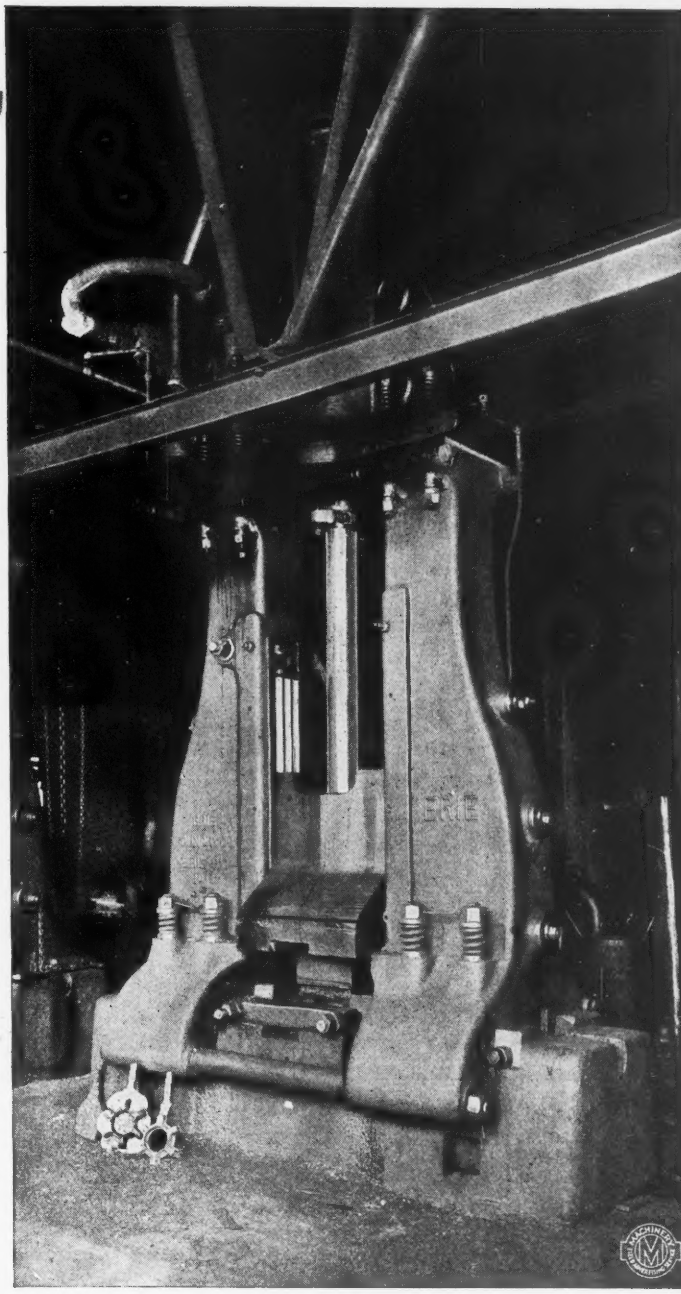
ERIE

Drop Hammers

Help Make B & S Forged Tools Famous

About five years ago Billings & Spencer of Hartford, Conn., installed a pair of ERIE Steam Drop Hammers. These machines have been kept busy ever since, especially during the war, when they were in constant use, now contributing to the far-famed strength and efficiency of B & S Tools, now on outside work of which an example is shown—a drop forged main-clutch, one of a lot designed for use in a line of special machines built by another concern.

These pieces are about 2 5/16″ thick, 9″ diameter at the outer ends of the arms, which are $1\frac{1}{8}$″ wide, and the center hole is $4\frac{5}{8}$″ diameter. Output is 22 pieces per hour, after which the clutches are trimmed as shown.



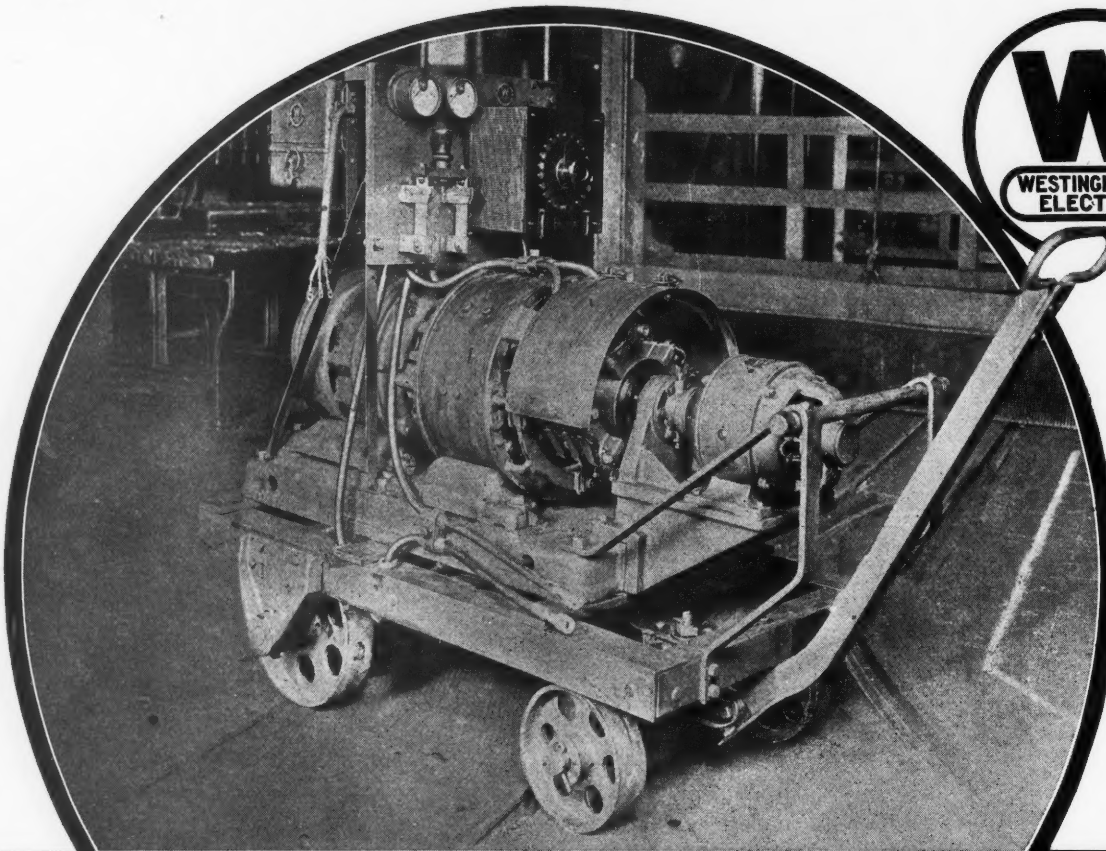
ERIE Steam Drop Hammers have been used for years in many well-known plants, where their rugged power, operating convenience and universal productiveness make them popular with all concerned and their exclusive advantages have given them a reputation well worth investigating.

Let us tell you more about them

Erie Foundry Company

ERIE, PA., U. S. A.

Westinghouse



Better Fusion—Deeper Penetration and more welds per day—

Ten points of the Westinghouse welding equipment that assure economy of operation, good penetration and the proper fusion:

1. Easy to strike and hold arc.
2. Reactor of low inductance.
3. Proper penetration of deposited metal.
4. Small current steps; less than 10 amperes.
5. Twenty one current steps obtained by adjusting only one device; namely, field rheostat. No change in rheostat setting required while changing from downward or vertical welding to overhead welding.
6. Electrode does not have a tendency to freeze to work.
7. A-C. motor provided with outside terminals for connecting for 220 or 440 volts.
8. Control panel mounted over set, making it compact and requiring minimum floor space.
9. Ammeter and voltmeter supplied on panel. Operator can readily check current and polarity.
10. Covered generator commutator and radial self-aligning ball bearings for set and exciter.

Bulletin 7149 is a valuable reference book on arc welding applications and the advantages of the Westinghouse arc welding equipment.

Write for a copy.

Westinghouse Electric & Manufacturing Co.

East Pittsburgh, Pa. Offices in all Principal American Cities

ARC WELDERS

ACME FORGING MACHINES

Maximum Output at Minimum Cost

The work, forging auto pinion shafts; the problem, minimum output at minimum cost; the solution, Acme Forging Machines.

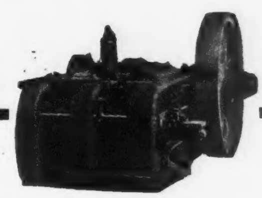
Upsetting is completed in three operations, the stock used is $1\frac{1}{8}''$ steel. The cold end of each shaft is placed against stop, then heated in die. A step on tredle completes first operation. This being a two-operation die the work is next placed in its lower section, the treadle again stepped on, and the second operation completed. After a quantity of work has piled up the dies changed and a single operation at opposite end of shaft completes the part as shown in sketch.

Our catalog will interest you. May we send you a copy?

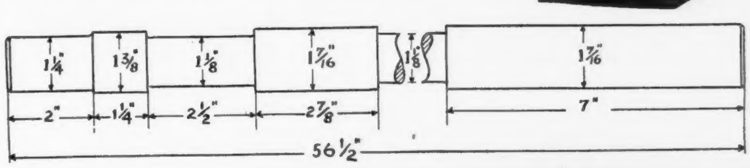
THE ACME MACHINERY COMPANY

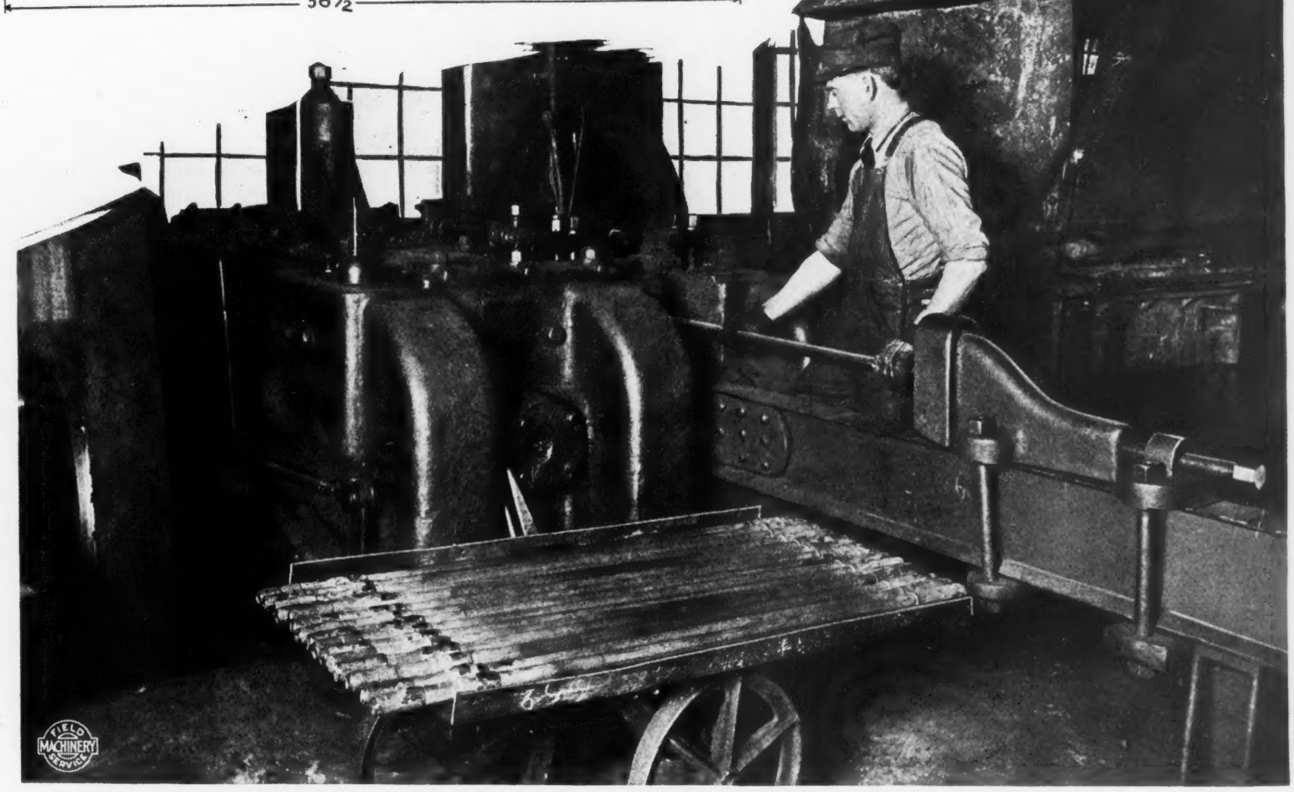
CLEVELAND OHIO, U. S. A.

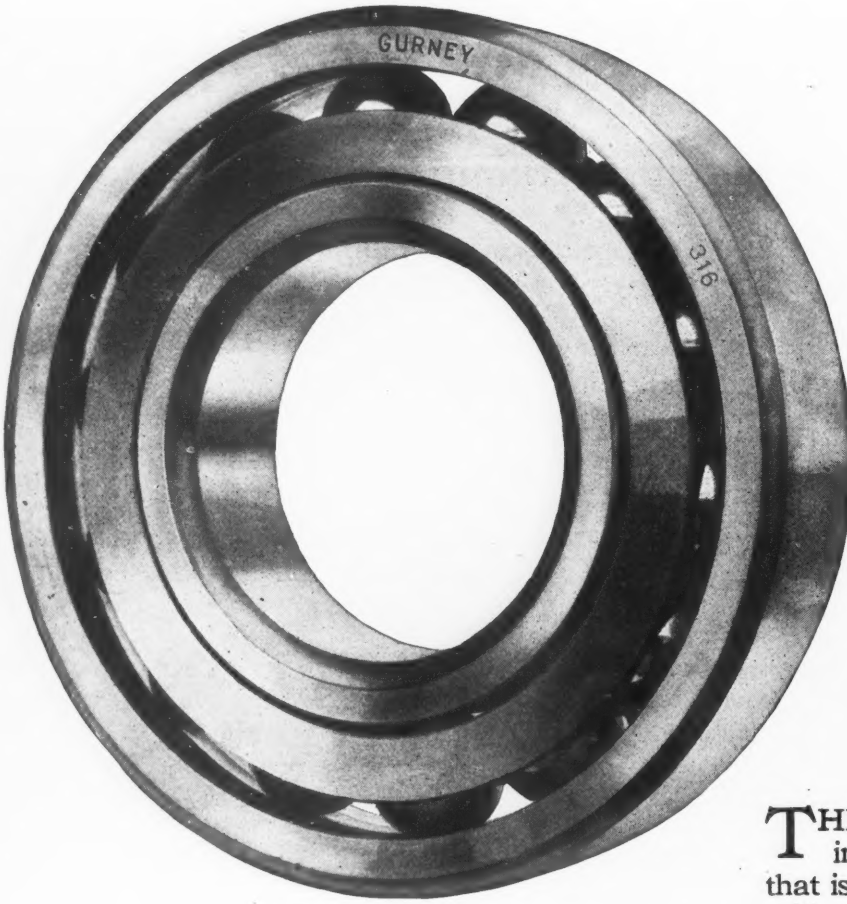
Foreign Agents: Burton, Griffiths & Co., Ltd., London.



Glaenzer & Perreaud, Paris, France.







Refinement

THE refinement that is embodied in a Gurney Bearing is something that is hard to explain to one unfamiliar with mechanical subtleties. It is something that has been attained by many years of patient and painstaking work, developing and perfecting processes and equipment, experimenting, testing, rejecting. Back of this bearing which looks so simple and easy to produce is this unseen background. It is this costly preparation that has made the realization of this thing possible. Engineering Service, based upon years of experience in the designing of bearings for all classes of machines, is at the service of any manufacturer. Write.

Gurney Ball Bearing Co.

Conrad Patent Licensee

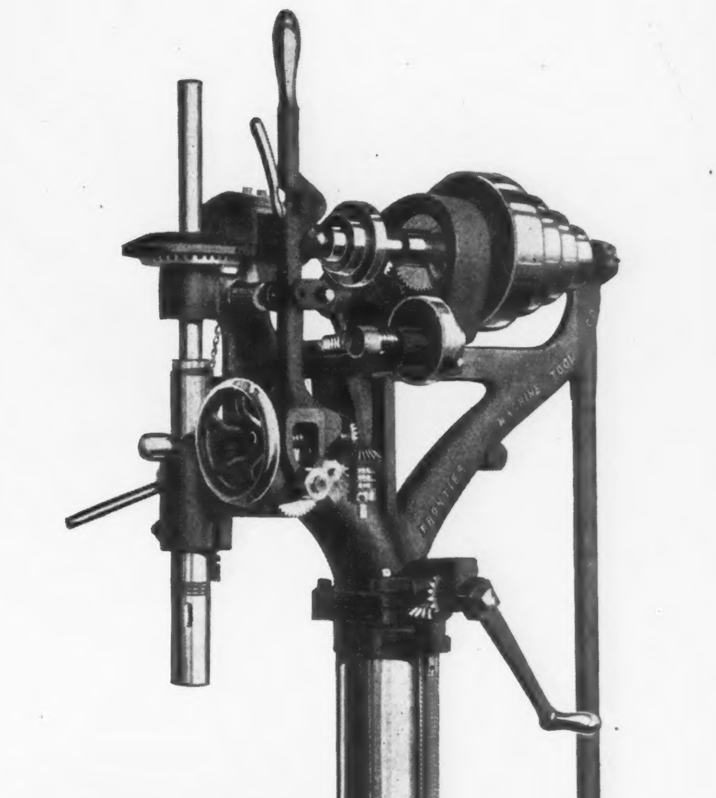
Jamestown, N. Y.

GURNEY
BALL BEARINGS

Frontier Super Drill

20-INCH SWING

"Speaking of Operations—"



(Ten good reasons why you should specify it.)

Reason No. 3

TWO MACHINES FOR THE PRICE OF ONE

Perhaps ninety per cent of the drilling operations of a twenty inch upright are such that perfect accuracy is not absolutely essential.

But that other ten per cent *MUST* be perfectly accurate.

For the ten per cent you buy a specially constructed HIGH PRICED machine which probably stands idle more than it is used.

NO WONDER

the other fellow can beat your costs for he has equipped his shop with a

Frontier Super-Drill

and does both classes of operations on the same machine.

He not only reduces production costs, cuts overhead and increases production, but he gets out BETTER WORK because the holes he drills are

100%

accurate instead of only

10%

That BACK COLUMN is the reason why.

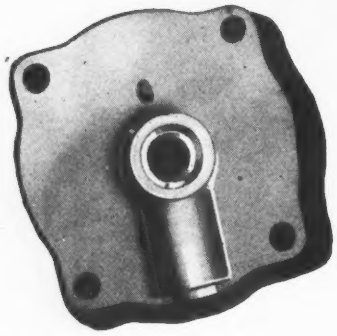
Catalogue on request.

Frontier Machine Tool Co., Inc.
122 Lakeview Ave. Buffalo, N. Y., U. S. A.

Castings for magneto with soft iron core for field accurately inserted.

Inserts—

greatly increase the usefulness and economy of Stewart Die-Molded Castings



Typical of hundreds of accurately centered inserted bronze or brass bearings.

THE use of inserts of different shapes and different metals practically removes the limitation of die-casting that otherwise would be imposed because the actual casting is confined to lower melting point metals and alloys.

Whether your parts are for electrical devices requiring soft iron for field pieces, or whether they require bearings and bushings of any type, or hardened wearing surfaces, Stewart Castings with inserts can be produced that will exactly meet your needs.

The parts illustrated here are merely representative of different uses of inserts; there are hundreds of variations of each use.

The embodying of inserts or chills in ordinary sand castings is limited to larger parts and is only feasible where great accuracy is not essential. Accurately and rigidly incorporated in the casting by the Stewart process, inserts permit lighter parts of greater effectiveness, and eliminate costly assembling and machining operations.

Place a sample part, or drawing of it, before experienced Stewart engineers, stating quantity desired. You will receive some suggestions about reducing your manufacturing costs that will surprise you!

Phonograph needle holder with stamping inserted for connecting with reproducer diaphragm. Insert must be firmly held or tone quality would be impaired.

STEWART MANUFACTURING CORP.
4500 Fullerton Avenue, Chicago

Also manufacturers of Stewart Bronze-Back Bearings

Stewart

GOOD MARKS

Good marks depend upon the *perfection* of the stamps with which the marks are to be made.

The science with which stamp forgings are treated—the degree of uniformity in temper—and the skill and accuracy with which the characters are engraved *determine* the *ability* of a stamp to make only ordinary marks or *good marks.*

Over seventy years' experience in making stamps, means that in Matthews Stamps you will find embodied the seasoned "know how" which makes possible stamps that will produce really *good marks* and give lasting service.

To whom, then, should *you* look when in the market for devices to make *good marks?* Sooner or later *you* will *insist* upon such stamps. *Consult us now.*

Jas. H. Matthews & Co.
2245 Forbes Field
PITTSBURGH, PENNA.

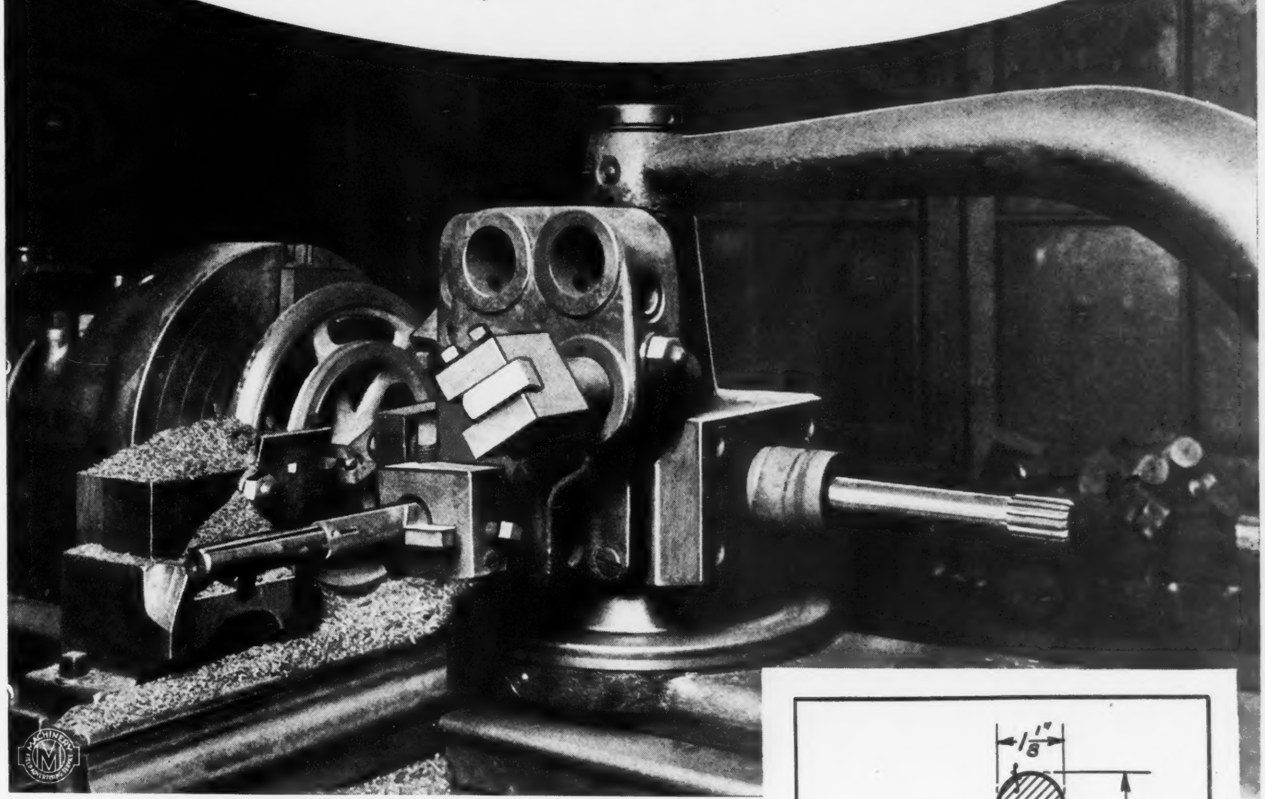
MATTHEWS
A PRODUCT WORTH MARKING IS WORTH MARKING RIGHT
MARKING DEVICES

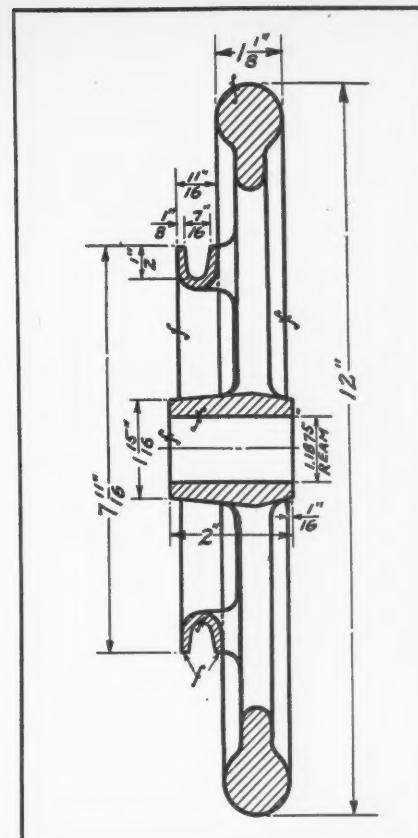
A booklet explaining how Matthews Stamps are made and showing numerous ways to use them will be mailed upon request.

MATTHEWS

MAKERS OF MARKING DEVICES SINCE 1850

POTTER & JOHNSTON AUTOMATICS





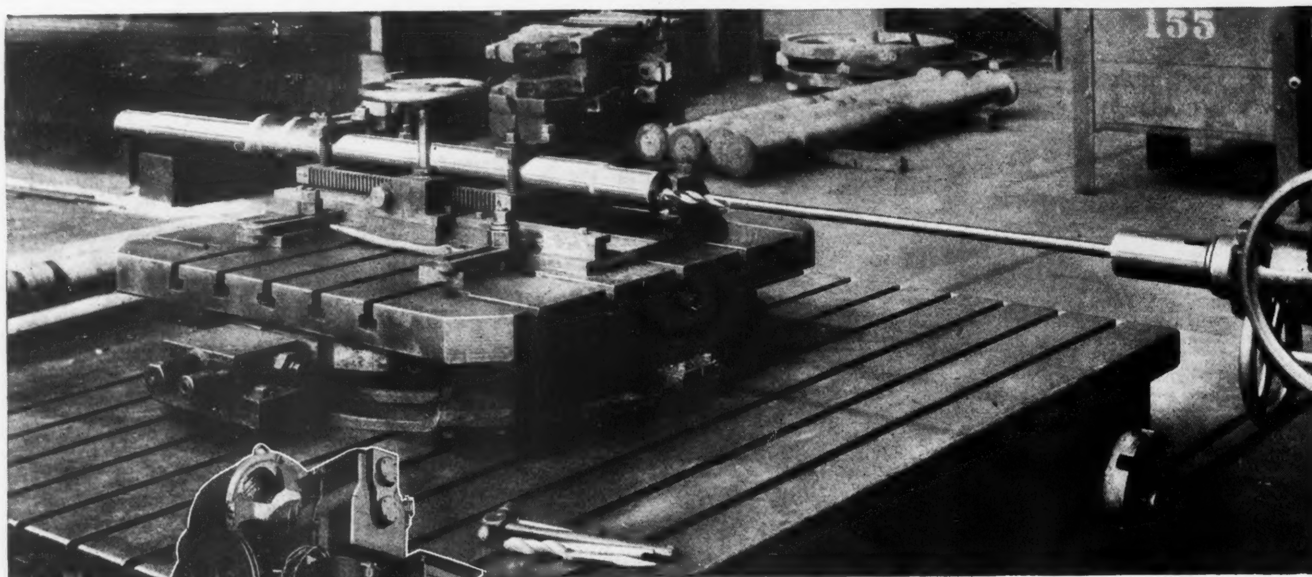
A Sewing Machine Hand Wheel Every Sixteen and a Half Minutes

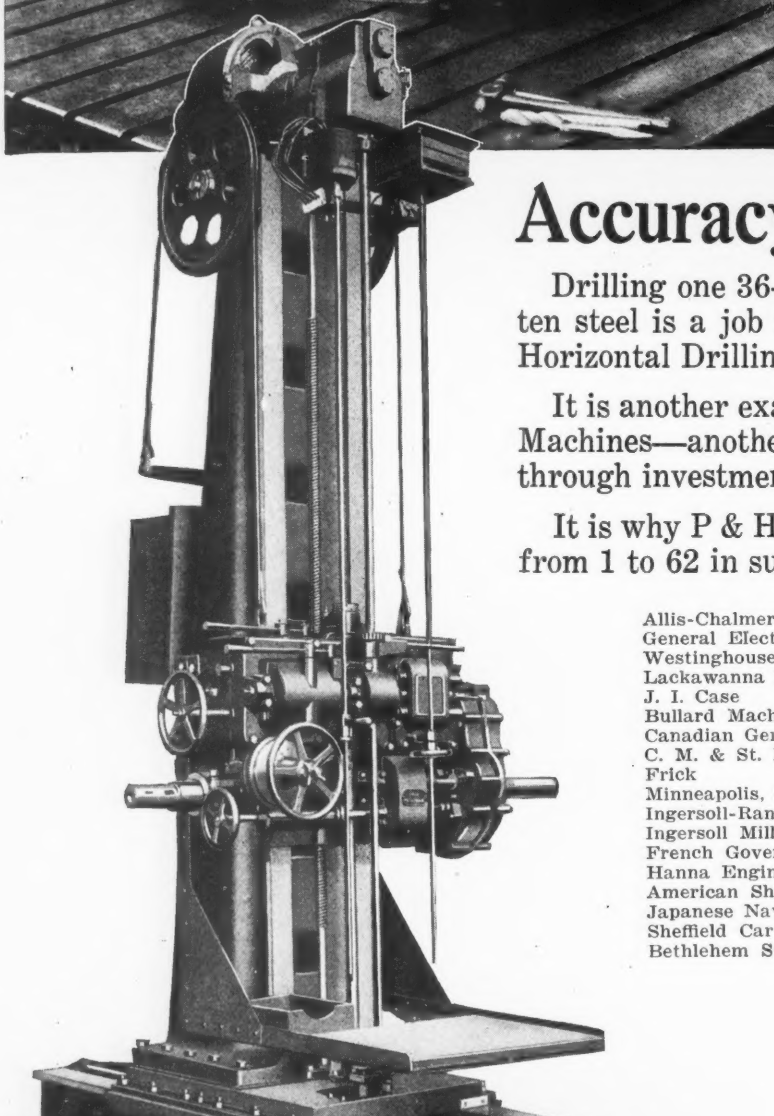
Two men are sufficient to operate the battery of eight P & J Automatics which speeds production for the Landis Machine Company of St. Louis, Missouri. All that is necessary is to load and unload. An example of the type of work Potter & Johnston Automatics are doing here is shown in photograph and sketch. The part is a sewing machine hand wheel on which operations are as follows:—1st Turret Position—rough bore; rough face intermediate diameter; rough face hub; form handle, using cross slide tool; finish turn 7 11/16" diameter. 2nd Turret Position—finish face intermediate diameter, (adjacent to grooved position), using cross slide tool; bore, using piloted tool; groove, using cross slide tool; finish inside radius of handle; finish face hub. 3rd Turret Position—ream. The stop-watch reading for these operations, plus loading and unloading work, was only 16 minutes and 30 seconds.

P & J production and price figures on your work will interest you. Send prints and specifications for same.

POTTER & JOHNSTON, Pawtucket, R. I., U. S. A.

New York Office: Hudson Terminal Building, 50 Church Street, Walter H. Foster, Manager. Detroit Office: The Potter & Johnston Agency Co., 535 Bates Street. Chicago Office: 1001 McCormick Building, Charles H. Shaw, Manager. Pacific Coast Offices: Title Insurance Bldg., Los Angeles, 75 Fremont St.; San Francisco, Louis G. Henes, Manager. Toronto Office: 11 Wellington Street, East, E. C. Roelofson, Manager. Foreign Offices and Representatives: Office for Great Britain, France, Italy, Belgium, Switzerland, Spain and Portugal: Potter & Johnston Machine Co., 68 Ave. de la Grande Armee, Paris, France, J. Ryan, Manager. Charles Churchill & Co., Ltd., London, Birmingham, Manchester and Newcastle-on-Tyne, England, and Glasgow, Scotland. Ercole Vaghi Corso Porta, Nuova, 34 Milan, Italy. Rylander & Asplund, Stockholm, Sweden. Yamatake & Company, No. 1 Yurakucho, Ichome, Kojimachiku, Tokyo, Japan.



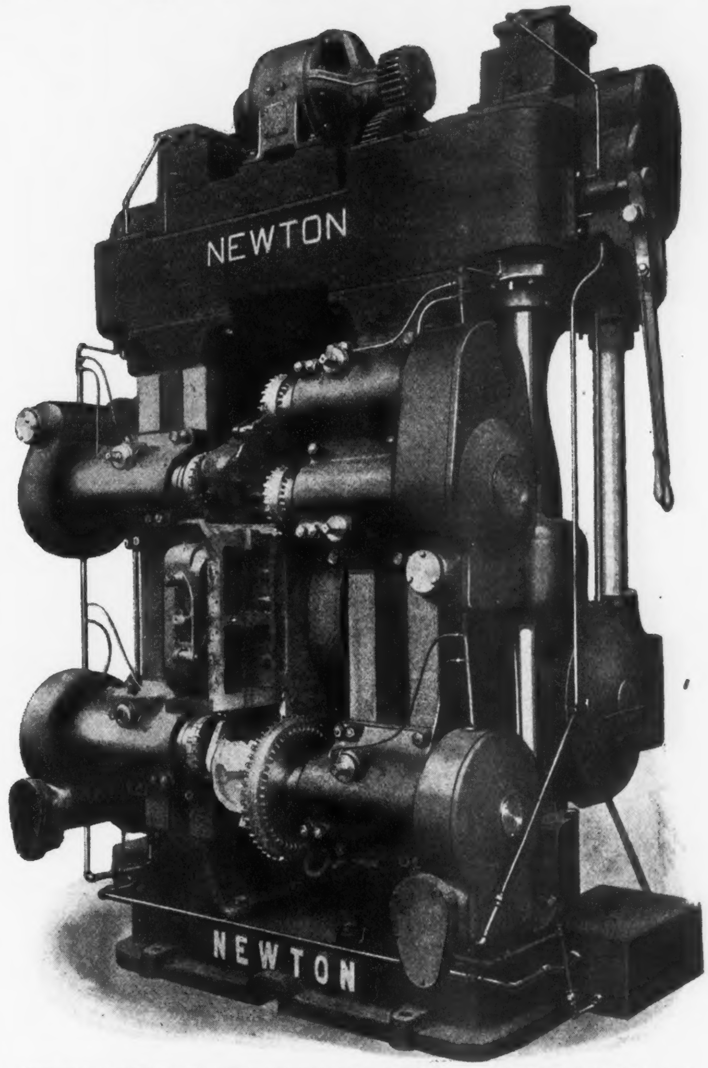


P. & H. No. 10 Drilling and Boring Machine

NEWTON

(REGISTERED TRADE MARK)

Labor Raised to the Highest Efficiency with Specialized Equipment



NEWTON DRUM TYPE CONTINUOUS MILLING MACHINE (MODEL 0-4)
MILLING TOPS AND BOTTOMS OF 4-CYLINDER BLOCKS SIMULTANEOUSLY

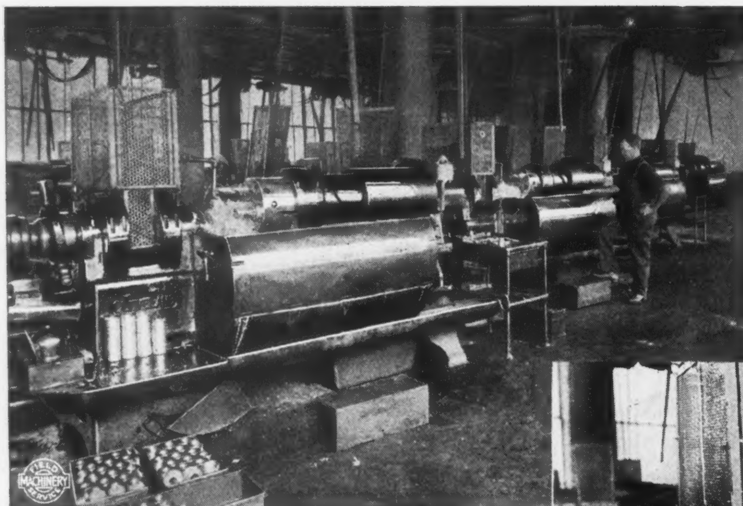
PRODUCTION—25 PER HOUR

The manufacturer whose plant is equipped with up-to-date machinery for economic manufacture will be able to maintain a safe margin of profit in a competitive market.

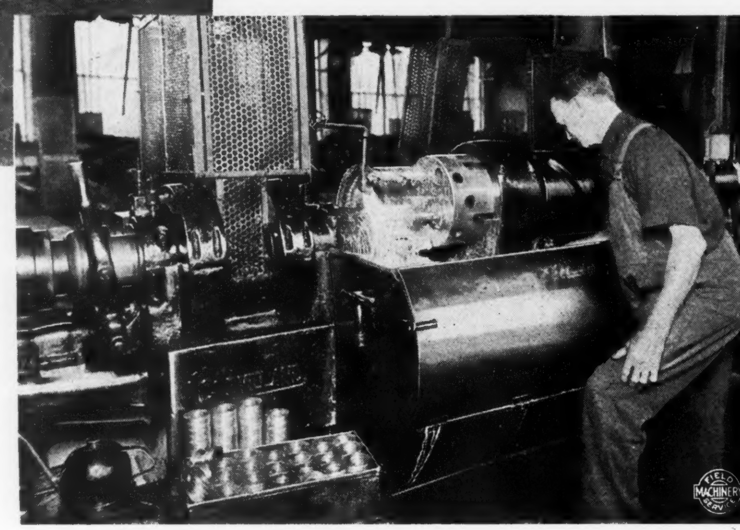
NEWTON MACHINE TOOL WORKS, Inc.

Twenty-Third and Vine Streets **PHILADELPHIA, U. S. A.**

CLEVELAND



Twenty Cleveland Automatics in This Plant— ⅞" to 7¾" Capacity



3/32" TO 7¾" 18" FEED
CLEVELAND'S CAPACITY UNEQUALED

Most of this large installation of Cleveland Automatics—in the Nice Ball Bearing Company's plant, at Philadelphia, Pa.—is used in making ball-race blanks in a wide variety of sizes.

The close-up shows a 3¾" machine turning out nickel steel blanks to dimensions shown in the accompanying sketch—4 races at a time; there being four cutting-off tools on the cross slide as shown.

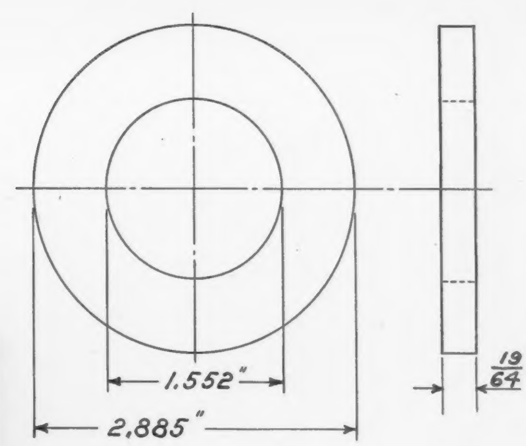
The operations involved are as follows: 1st., feed stock 1½"; 2nd., drill; 3rd., bore and turn; 4th., cut off. Production is 30 pieces per hour.

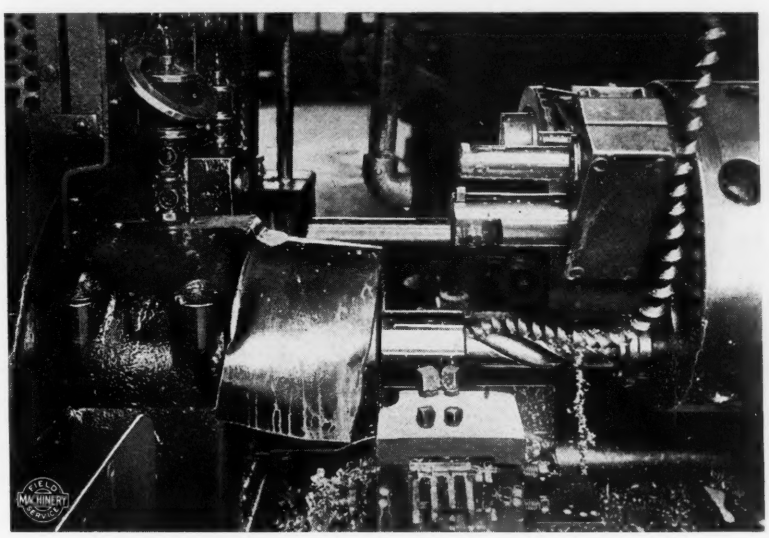
AGENTS: J. B. Anderson, 211 Gowan Avenue, Mt. Airy, Philadelphia, Pa. Herbert E. Nunn, 565 West Washington Street. Chicago, Ill. England, Charles Churchill & Co., London, England. Japan, Andrews & George Co., Tokyo, Japan. Belgium, Henri Benedictus Brussels, Belgium.

THE CLEVELAND AUTOMATIC

AUTOMATICS

Making Nickel Steel Ball-race Blanks—Thirty Per Hour





3/32" TO 7¾" 18" FEED CLEVELAND'S CAPACITY UNEQUALED

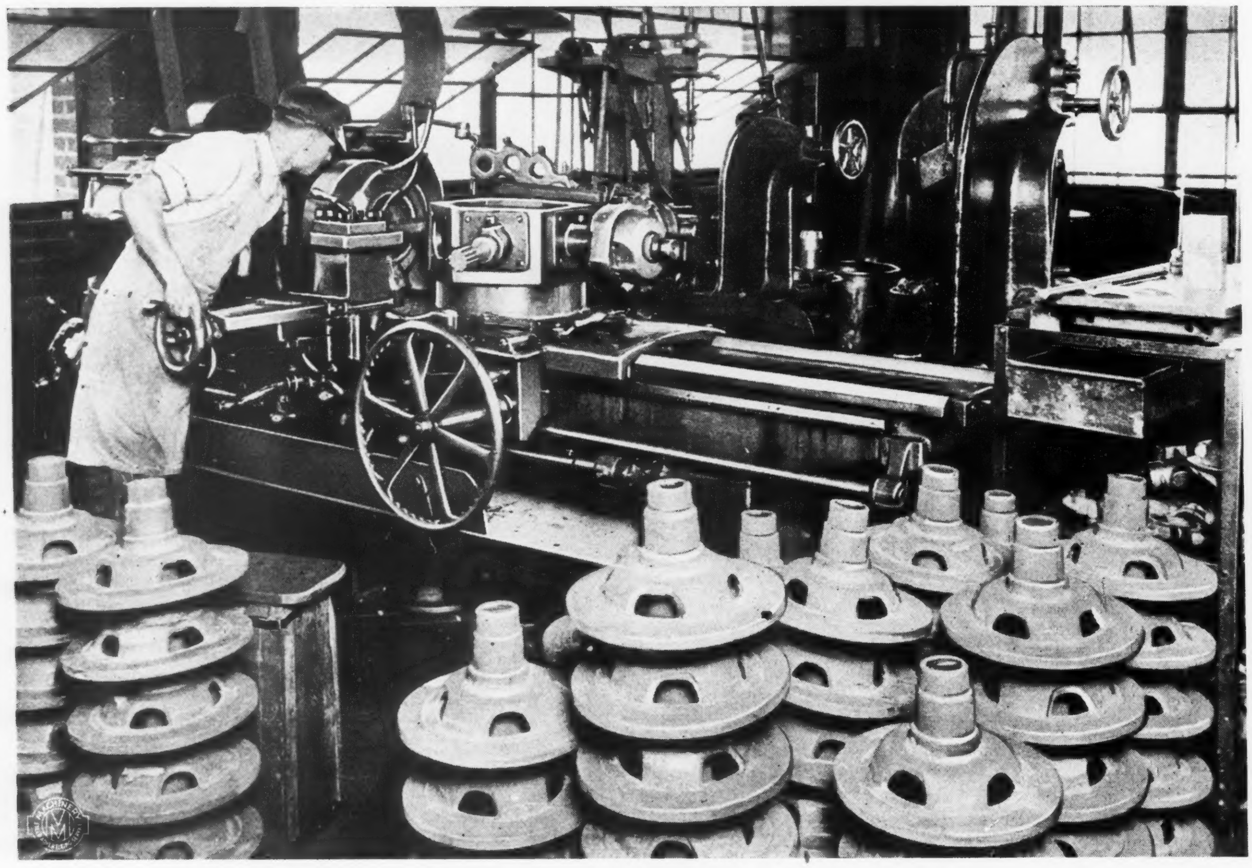
Cleveland Automatics are rapid, accurate producers on a wide range of work. They can be operated in battery by inexperienced mechanics, cost little for upkeep and give years of service without a hint of trouble.

They are equally well adapted to bar and chuck work, can be equipped with magazine attachments to accommodate small forgings or castings and can be tooled to produce practically any shape within limits of 3/32" to 7⅜" diameter and 18" long.

Estimates from samples or blueprints. Details on request.

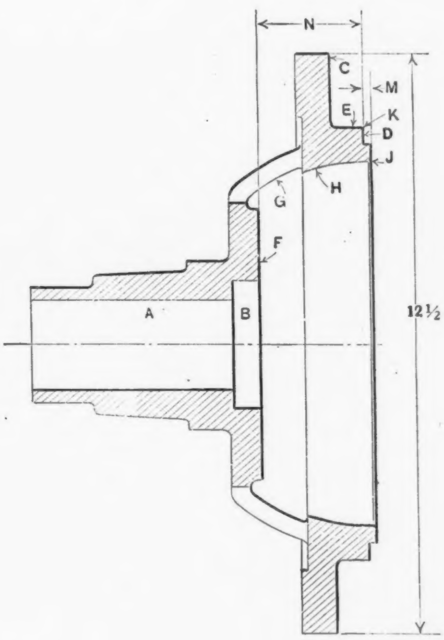
AGENTS: Denmark and Norway, Chr. A. Herstad, Copenhagen, Denmark. France, Holland and Colonies, R. S. Stokvis & Zonen, Paris, France, and Rotterdam, Holland. Switzerland, J. Lambercier & Co., Zurich and Geneva, Switzerland. Spain and Portugal, American Machinery Syndicate, 35 West 39th Street, New York, N. Y.

MACHINE CO., Cleveland, O., U.S.A.

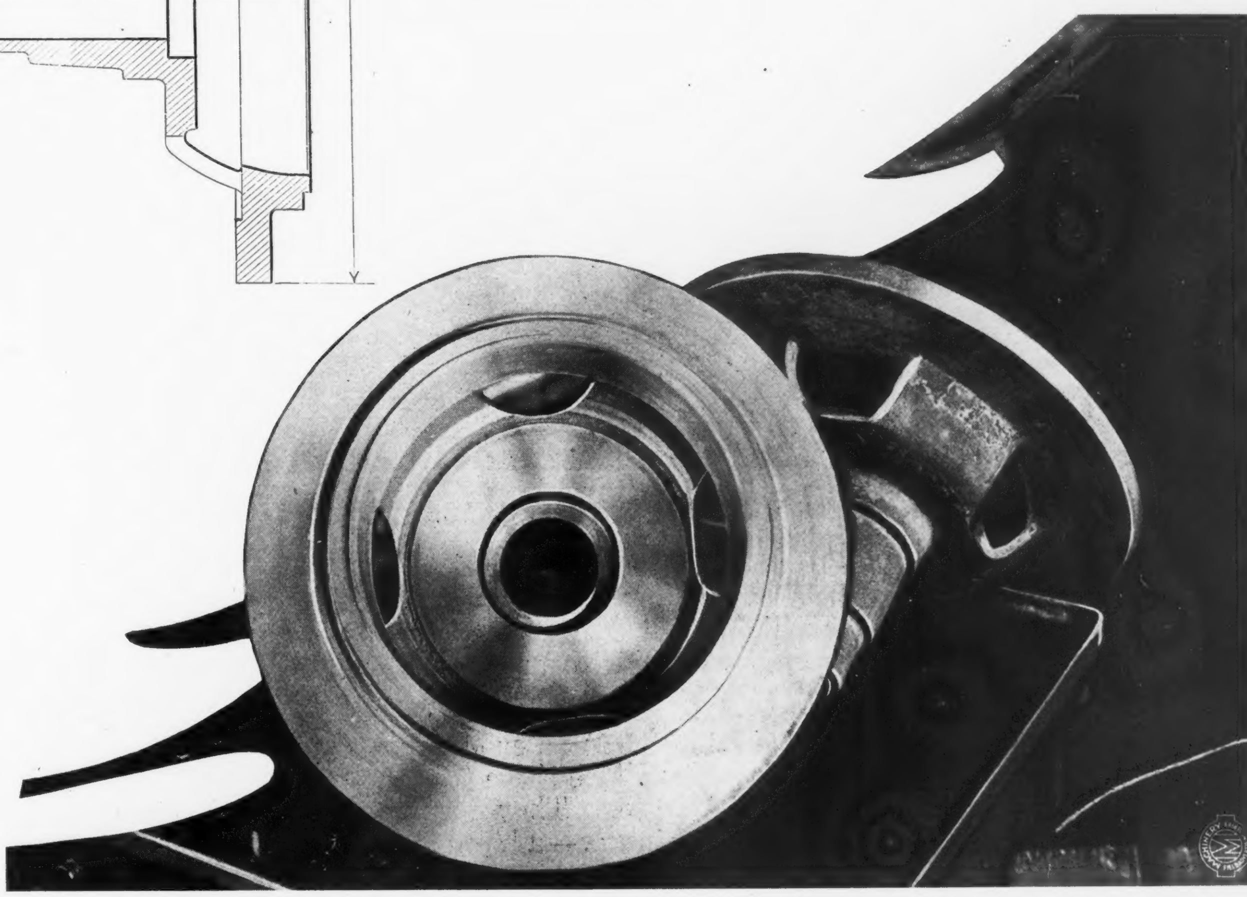


TURRET LATHES

One of Many in this Well-Known Plant



"Typical" work on Warner & Swasey turret lathes usually means a startling saving over previous methods. Let us send you facts and figures on work resembling yours. Or send us blue prints of your work for estimate. Send now, so you'll have the information the minute you need it, if you don't need it now.



COMPANY, Cleveland, U. S. A.

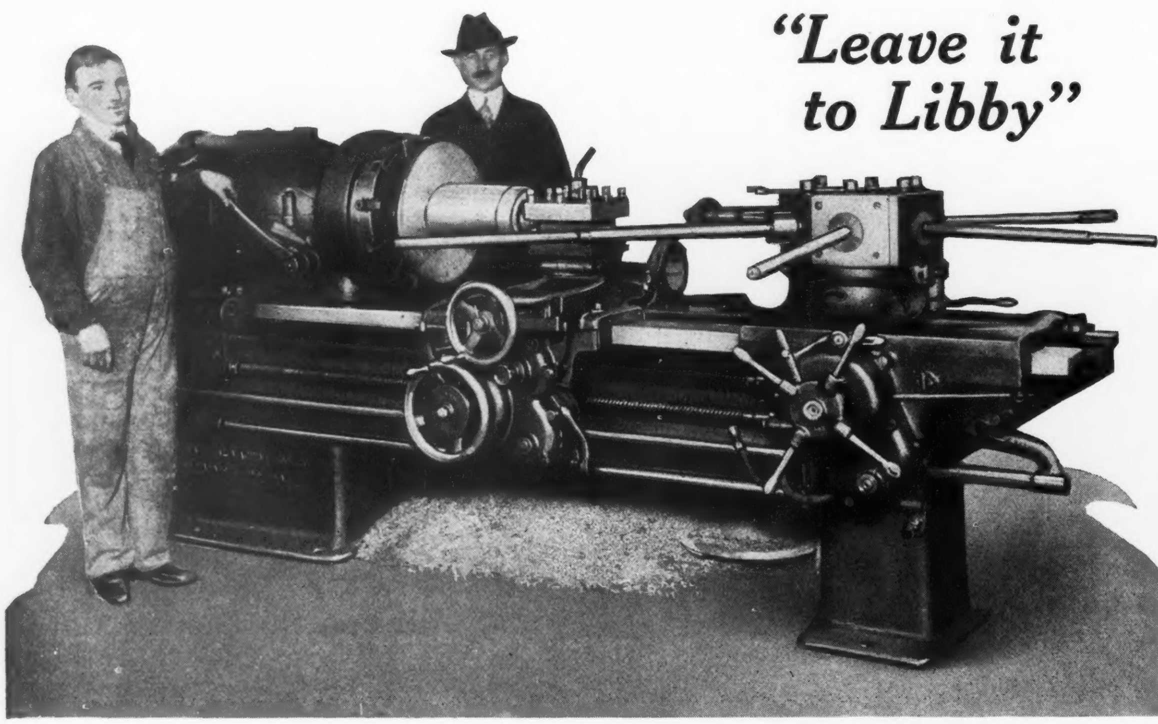
Detroit: 5928 Second Boulevard
Indianapolis: 940 Lemcke Annex

Milwaukee: 209 Sycamore Building
Dayton: 518 Mutual Home Building

FOREIGN AGENTS

Charles Churchill & Company, Ltd., London, Birmingham, Manchester, Bristol, Newcastle-on-Tyne, Glasgow.
Allied Machinery Company, Paris, Turin, Zurich, Barcelona, Brussels.
Wilhelm Sonesson Company, Malmo, Copenhagen, Stockholm, Gothenburg.
R. S. Stokvis en Zonen, Rotterdam.
Benson Brothers, Sydney, Melbourne, Adelaide.
Yamatake Company, Tokyo, Osaka, Nagoya, Fukuoka, Dairen.
McLeod & Company, Calcutta.
Andersen, Meyer & Co., Ltd., Shanghai.

LIBBY LATHES



The First Libby Lathe—Thirteen Years in Service—is Still Doing First-class Work

If the first Libby Lathe should have anything written off its value neither its owner nor operator will admit it. Here they are, both beside the machine, which, after thirteen years continuous work, is still to all intents and purposes as good as ever.

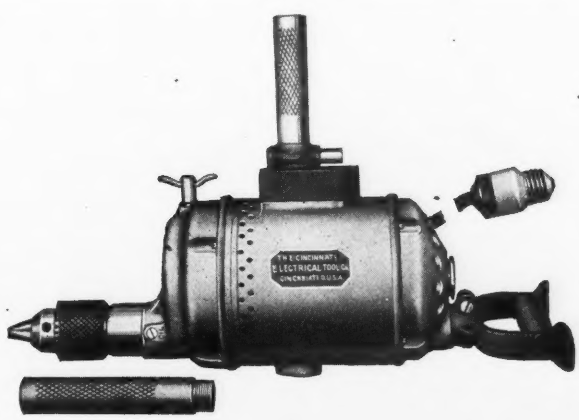
This Libby Lathe is in the plant of the Minster Machine Company, Minster, Ohio, and the concern believes it will be there for many years yet. Libby Lathes have many important features. They may, for instance, be changed from chuck to bar work in 20 minutes—a big item with varying requirements.

Get posted on Libby Lathes as they are today. Write for the catalog.

INTERNATIONAL MACHINE TOOL CO.

INDIANAPOLIS **INDIANA, U. S. A.**

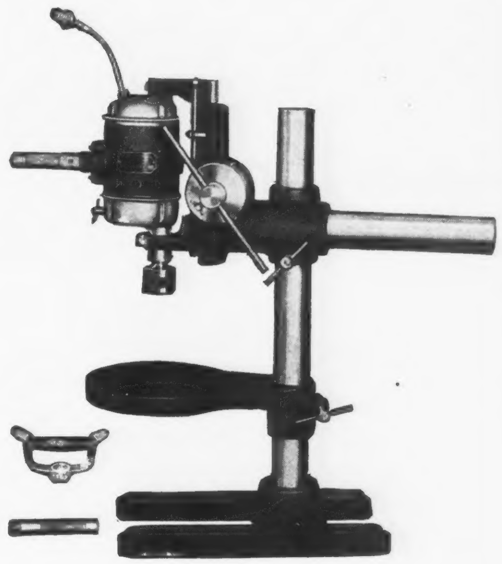
DOMESTIC AGENTS: Aumen Machinery Co., Baltimore, Md.; Blackman-Hill-McKee Mchy. Co., St. Louis, Mo.; Brown & Zortman Machinery Co., Pittsburgh, Pa.; Eccles & Smith Co., San Francisco, Calif., Los Angeles, Calif., Portland, Ore., Seattle, Wash.; E. L. Essley Machinery Co., Chicago, Ill., Moline, Ill., Milwaukee, Wis.; Fairbanks Co., New Orleans, La., Birmingham, Ala.; Hill, Clarke & Co., Boston, Mass.; Northen Machinery Co., Minneapolis, Minn.; Seifreat-Woodruff Co., Cincinnati, Ohio, Dayton, Ohio; Strong, Carlisle & Hammond Co., Detroit, Mich., Cleveland, Ohio; Syracuse Supply Co., Syracuse, N. Y., Buffalo, N. Y., Rochester, N. Y.; Vandyck Churchill Co., New York, N. Y., New Haven, Conn., Philadelphia, Pa. FOREIGN AGENTS: Andersen, Meyer & Co., Shanghai, China; Coats Machine Tool Co., London, England; Ing. Ercole Vaghi, Milan, Italy; Isbecque, Todd & Co., Belgium; Iznosskoff & Co., Petrograd, Russia, Moscow, Ekaterinburg, Russia; V. Lowener, Copenhagen, Denmark, Christania, Norway, Stockholm, Sweden; Victor B. Mendoza Co., Havana, Cuba; Moerch & Roumet, Paris, France.



CINCINNATI

Portable Electric Drill and Bench Drill Press—

You Need Them Both



—There are many jobs around shop and factory that demand stationary drilling apparatus—and likewise a great deal of work where the use of a portable drill is essential. You need both tools—

—And the combination of Cincinnati Portable Electric Drill and Bench Drilling Stand gives them to you at much less than the cost of two entirely separate machines.

—It takes but a few seconds' time to convert your Cincinnati Drill into a drill press—and only a few seconds to change it back to a portable drill. No belts or pulleys are needed—the stand can be set up and used in any part of the shop. The high character of the workmanship employed in making them insures accurate drilling in either case—the quality materials of which they are made means long, continuous service.

If you have a Cincinnati drill, add a drilling stand to your outfit; if you have neither, investigate this combination at once. The complete Cincinnati line includes Portable Electric Drills, Grinders and Buffers—used everywhere since 1902. Our catalog tells more about them. Write for it.

The Cincinnati Electrical Tool Co.

Dept. A-6

1501-1505 Freeman Ave. Cincinnati, Ohio

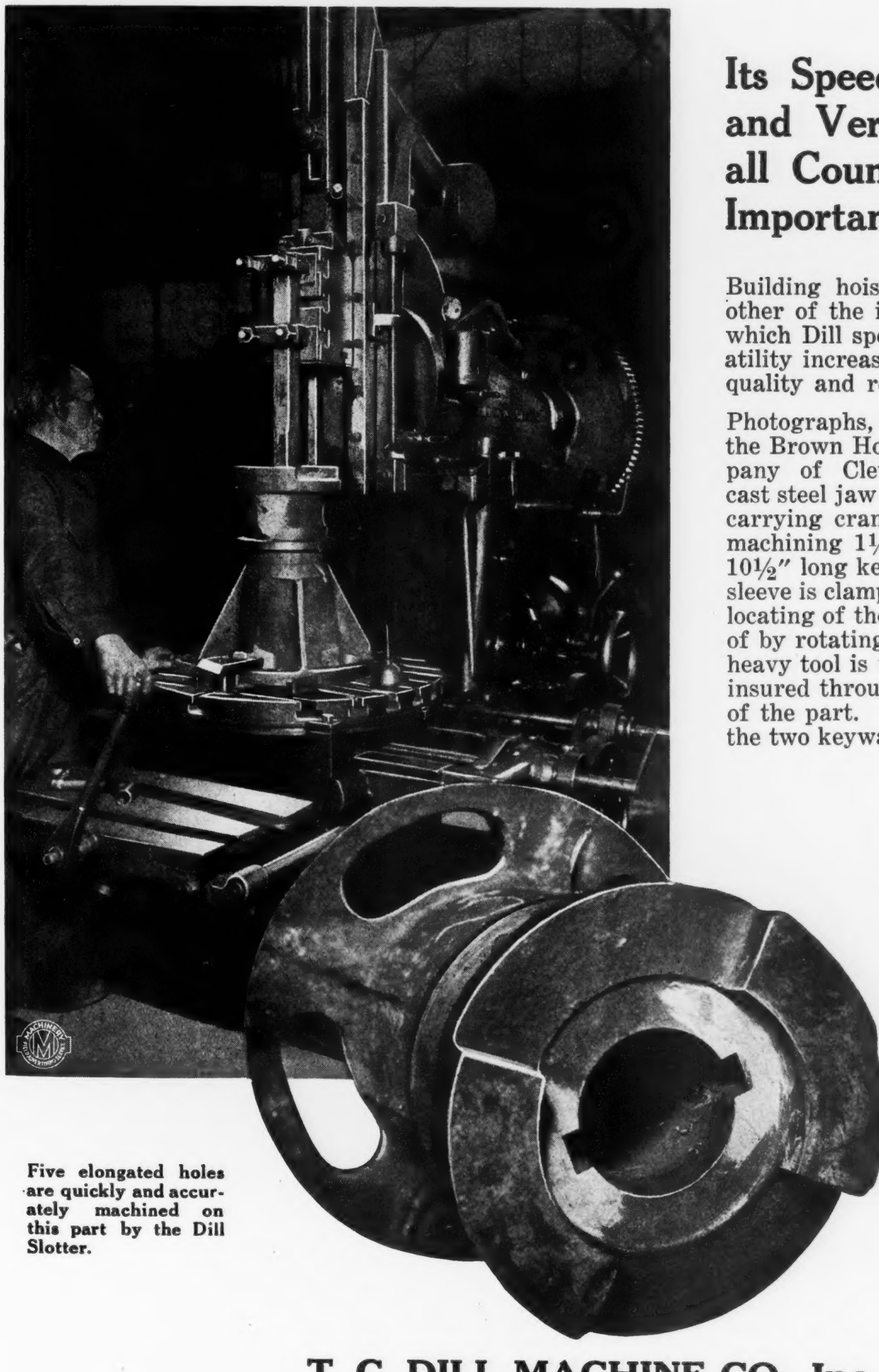
BOSTON	NEW YORK	DETROIT
259 Franklin St.	50 Church Street	8242 Woodward Ave

FOREIGN AGENTS:

England—S. Wolf & Co., London. Australia—Parke & Lacy Co., Ltd., Sydney. France—R. S. Stokvis & Fils, Paris. Holland—R. S. Stokvis & Zonen, Ltd., Rotterdam. Belgium—R. S. Stokvis & Fils, Brussels. Japan—Yamatake & Co., Tokyo. China—Andersen, Meyer & Co., Ltd., Shanghai. Spain—American Machinery Corp., S. A. C., Madrid. Portugal—Sindicato De Maquinaria Americana, Bilbao.

THE DILL SLOTTER

An Ideal Machine for Building Hoisting Machinery



Its Speed, Accuracy and Versatility all Count on this Important Work

Building hoisting machinery is another of the important industries in which Dill speed, accuracy and versatility increase production, improve quality and reduce factory costs.

Photographs, taken in the plant of the Brown Hoisting Machinery Company of Cleveland, Ohio, show a cast steel jaw clutch sleeve for an ore carrying crane, and the Dill Slotter machining 1⅛" wide, ½" deep and 10½" long keyways in same. After sleeve is clamped on the Dill table the locating of the keyways is taken care of by rotating the circular table. A heavy tool is used and a uniform cut insured throughout the entire length of the part. Floor to floor time for the two keyways is one hour.

Write for interesting illustrated booklet showing the Dill Slotter in actual operation.

Five elongated holes are quickly and accurately machined on this part by the Dill Slotter.

These two keyways are the work of the Dill Slotter. Note that material is cast steel.

T. C. DILL MACHINE CO., Inc.

THE DILL SLOTTER PEOPLE, Philadelphia, Pa.

FOREIGN AGENTS: Alfred Herbert, Ltd., British Isles. Alfred Herbert, Ltd., Yokohama, Japan. Societe Anonyme Belge, Alfred Herbert, Brussels, Belgium. Societe Anonyme, Alfred Herbert, Ltd., Paris, France. Societa Anonima Italiana, Alfred Herbert, Ltd., Milan, Italy.

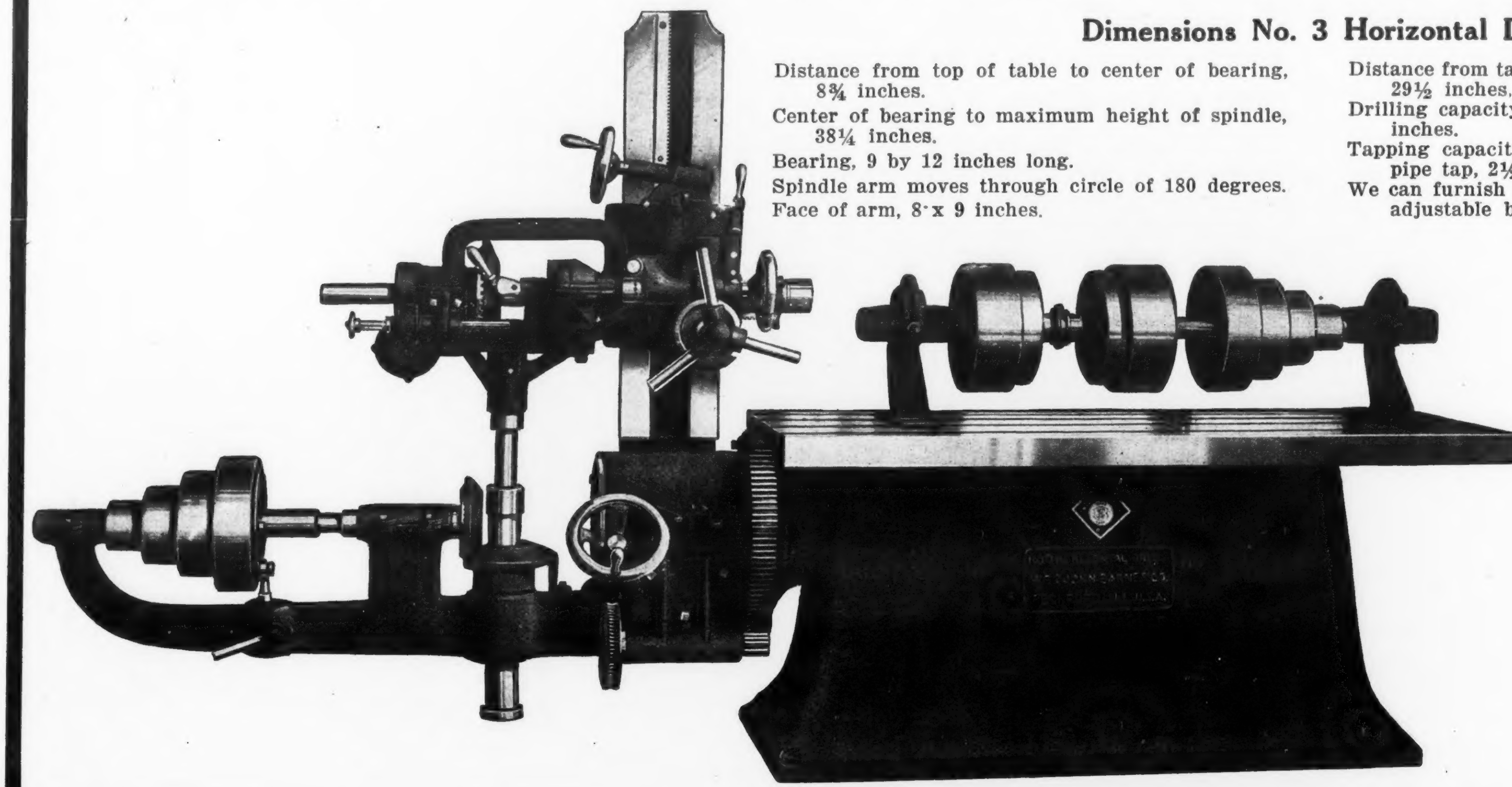
BARNES RADIAL DRILL

Spindle Travel 18 inches
No. 4 taper hole in spindle
Weight 3,300 lbs.
Table 24" x 65"

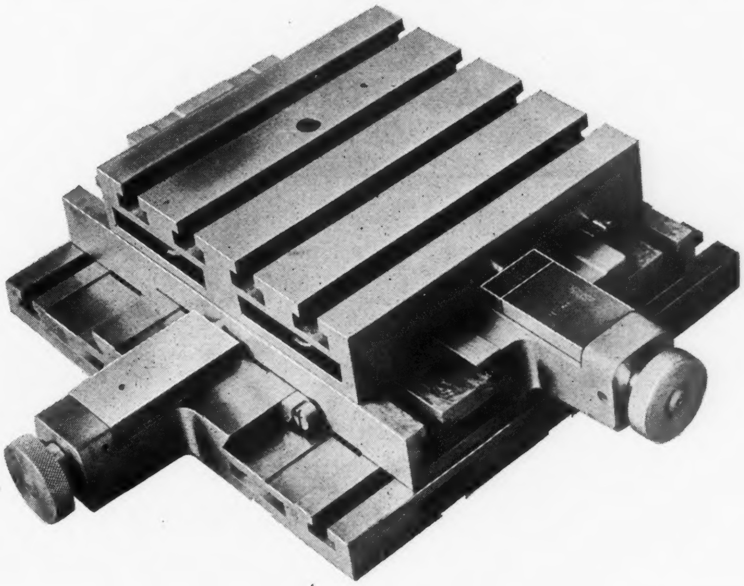
WE illustrate herewith a No. 3 Horizontal Radial Drill or End Drilling and Tapping Machine. The machine is back-geared, strong and well built, and all parts are within easy reach of the operator. The table is slotted for holding the work; the arm is of heavy box pattern, and the sliding head is gibbed strongly on the square ways of the arm. For operating the spindle, the operator has choice of three feeds; namely, the lever feed or the hand wheel feed or power feed. Power feed has positive drive.

Dimensions No. 3 Horizontal Drill:

Distance from top of table to center of bearing, 8¾ inches.
Center of bearing to maximum height of spindle, 38¼ inches.
Bearing, 9 by 12 inches long.
Spindle arm moves through circle of 180 degrees.
Face of arm, 8 x 9 inches.
Distance from table to center of spindle, maximum, 29½ inches, minimum, 2⅜ inches.
Drilling capacity in solid C. I., 3 inches; Steel, 2 inches.
Tapping capacity in C. I., 3 inches; capacity of pipe tap, 2½ inches.
We can furnish Arbor Rest (extra cost) which is adjustable both vertically and horizontally.



W. F. and John Barnes Co.
231 Ruby Street
Rockford Illinois



Johansson
ACCURACY

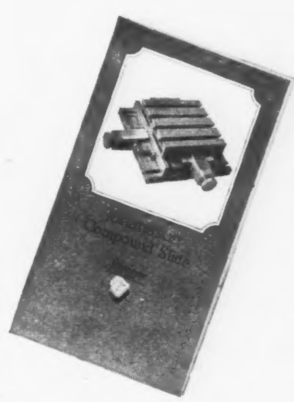
Paid for itself in one month

SO claims a Chicago tool manufacturer who recently put a JOHANSSON COMPOUND SLIDE to work in his shop. Very few modern inventions in tool-making have been received so enthusiastically alike by Manufacturers and Toolmakers. Assured accuracy in laying out holes has meant in the past many tedious hours of the most exacting work. With this new tool, a series of holes, in a die or fixture, can be located and drilled in a third of the time formerly required by the old button method.

AFTER determining the first position on a piece of tool work, it is only necessary to move the two slides in the proper directions and insert the correct Johansson Gage Blocks in order to obtain the other locations as desired. (See illustration above). There is no chance to go wrong, if the distances have been figured correctly. As the slides are clamped tight against the Blocks for each new position, unquestionable accuracy is assured. The Slides are 7½ in. x 7½ in. and the tool measures 3½ in. from the top surface to the base. The weight is fifty-five pounds.

THE JOHANSSON COMPOUND SLIDE operates on a vertical machine or can be clamped to the faceplate of a lathe. The fewer chances for mistakes, through its use, make it a popular tool with the workman. Its great economy appeals immediately to the manufacturer, who is confronted with the present high cost of tool making.

THE booklet shown here describes more in detail how the JOHANSSON COMPOUND SLIDE is used to advantage. It will be a pleasure to send a copy to anyone interested.



C.E. JOHANSSON · INC.
POUGHKEEPSIE, N.Y.

THE GARVIN PAGE

Issued by

THE GARVIN MACHINE CO.

Builders of Machine Tools since 1865

The Growth of the House of Garvin

based solely on the merits of its products—has been phenomenal.

Established in 1865—it occupies today a large modern fireproof building equipped with every facility for expediting the handling of its products and the convenience of its operations.

Our show room carries practically every machine listed in our comprehensive catalog—and gives the visitor an opportunity of seeing Garvin Machines in actual operation.

A corps of experts is ready to advise you regarding practically any metal product.

The time to get ready for the rush is now.

Why not drop in and look us over?

H. R. Garvin.

Speaking of getting down to rock bottom prices—

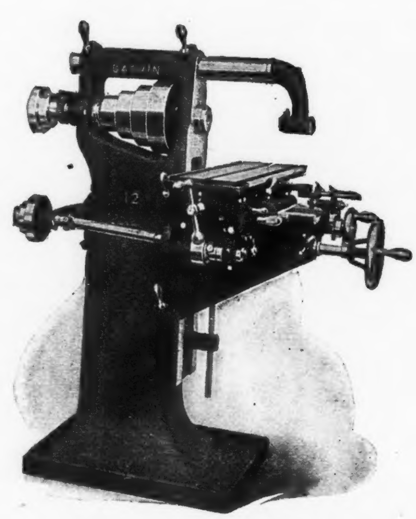
Has it occurred to you that to produce more economically and thereby reduce the selling price is the most logical means of stopping the present industrial slump?

—and has it occurred to you that Garvin Machines, on account of their many improvements for rapid production, are the logical means for helping you to this end?

Now when you have time for it, we can give you the very best engineering advice and consultation —free of charge— and you may rest assured that our engineers will recommend Garvin machines only when they serve your purpose best.

Write and tell us what you have in mind today

The Garvin Machine Co.
Spring and Varick Streets
New York City



Garvin No. 12 Plain Milling Machine

G-92

GARVIN

BUILDER OF BETTER MACHINE TOOLS

COLBURN BORING AND TURNING MILLS

"A Very Durable and Accurate Machine"

The above expression from the Thomas Elevator Company means much when you consider eight years of constant service from the Colburn Boring and Turning mill illustrated.

The piece shown is a cast iron Electric Hoist Drum and this Colburn Mill bores the 5-inch diameter hub and turns the 20-inch diameter barrel at the rate of one piece every 12 hours.

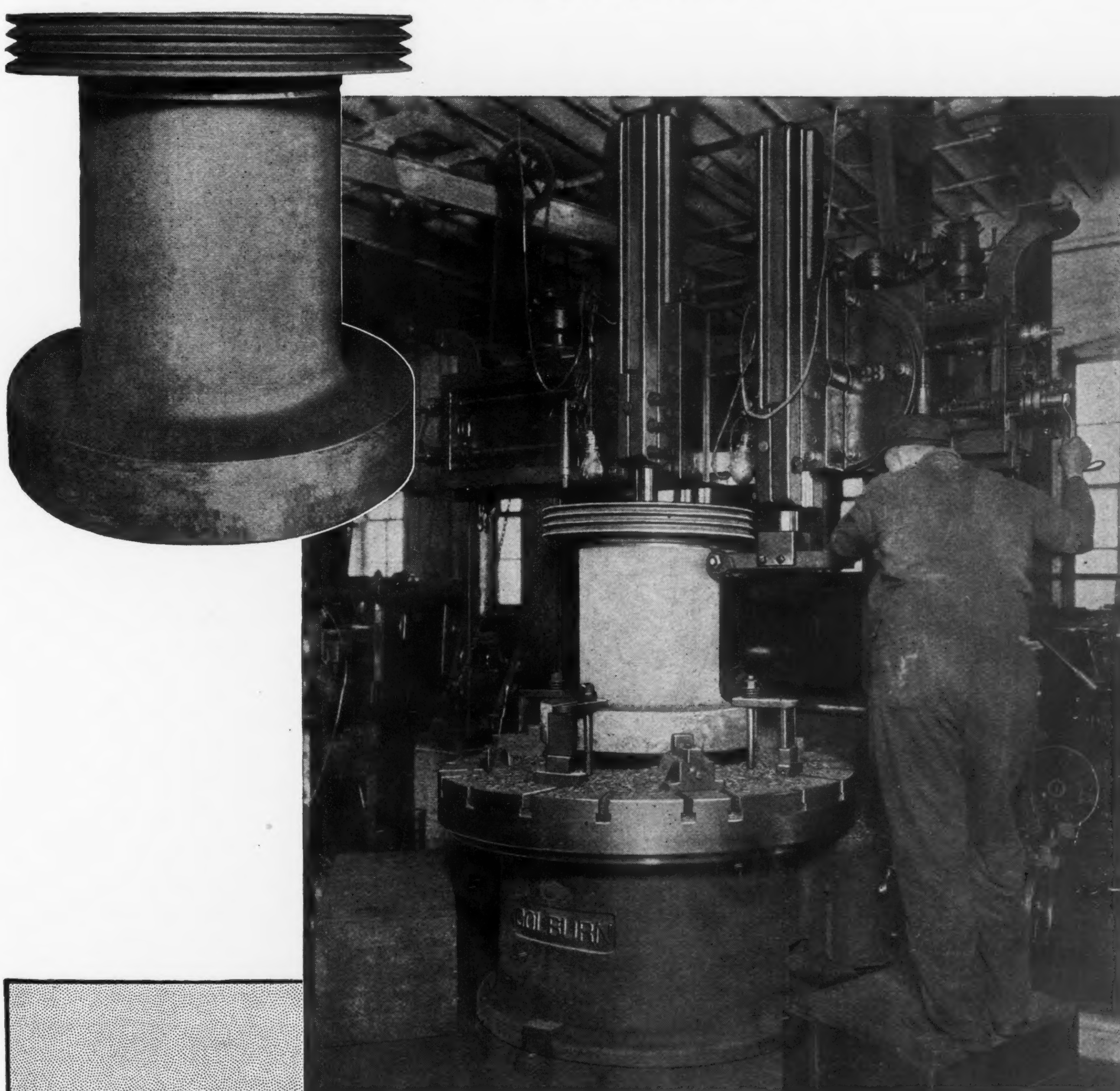
The accuracy and durability of the Colburn is the result of correct design, quality of materials built in, and careful workmanship. These same principles will work to advantage on your work. Let us show you how.

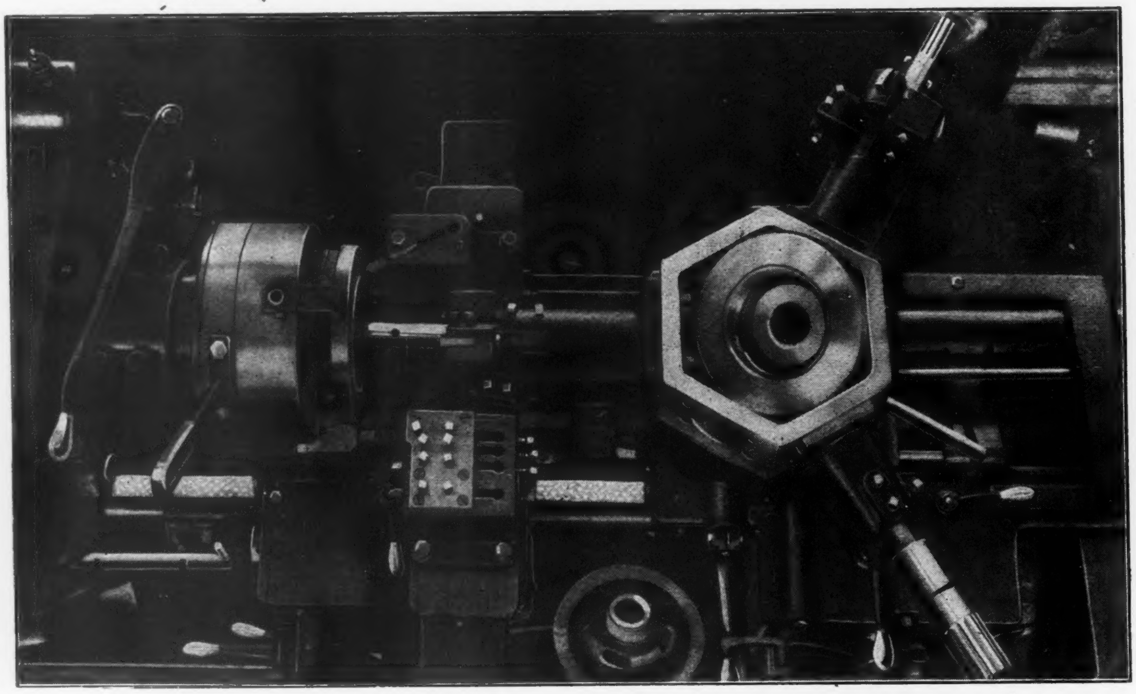
Simply send blueprints for estimates

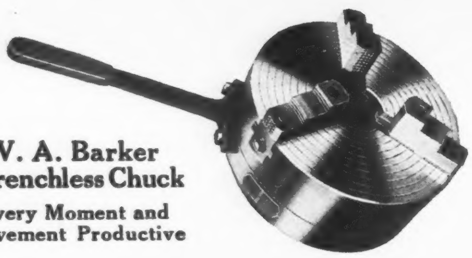
THE COLBURN MACHINE TOOL COMPANY

1038 IVANHOE ROAD CLEVELAND, OHIO

Builders Also of Colburn Heavy Duty Drill Presses







W. A. Barker
Wrenchless Chuck
Every Moment and
Movement Productive

What Foster Engineering Service Means to You

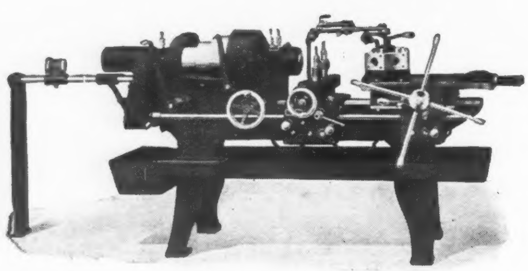
You want production, not merely a machine.

The real value of a machine to you is measured by its ability to produce.

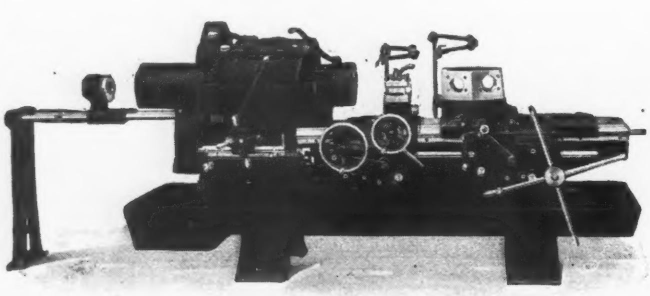
To be able to produce maximum, a machine must be tooled right and operated right.

We will gladly solve your tooling problems for you.

Send us your blue prints.



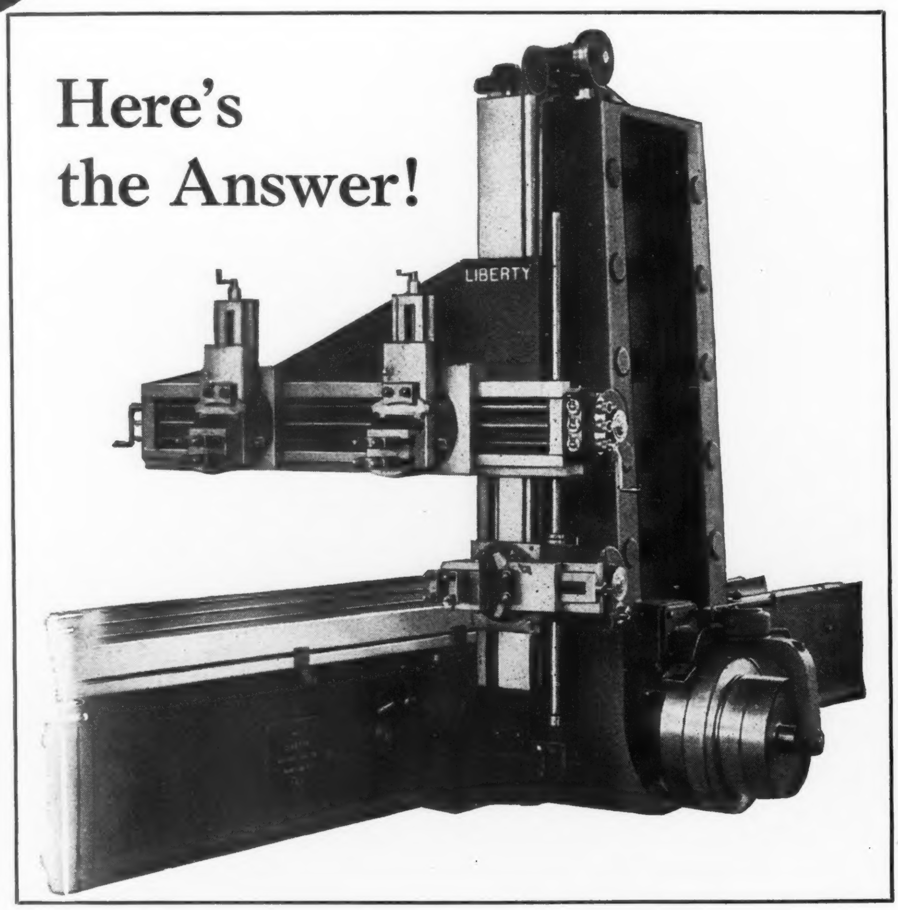
Foster Screw Machines - 5 Sizes



Foster Universal Turret Lathe—3 Sizes

FOSTER MACHINE CO., Elkhart, Ind.

LIBERTY MACHINE TOOLS



Question! What planing equipment must I install to successfully handle all work which enters my plant? Answer! The Quality Open-side Planer —that's all! It will give you adequate clearance on large and awkward shaped work; has power to cut to tool capacity, and, if you want it for ordinary work attach the left-hand housing, and you'll have a first-class four-head planer.

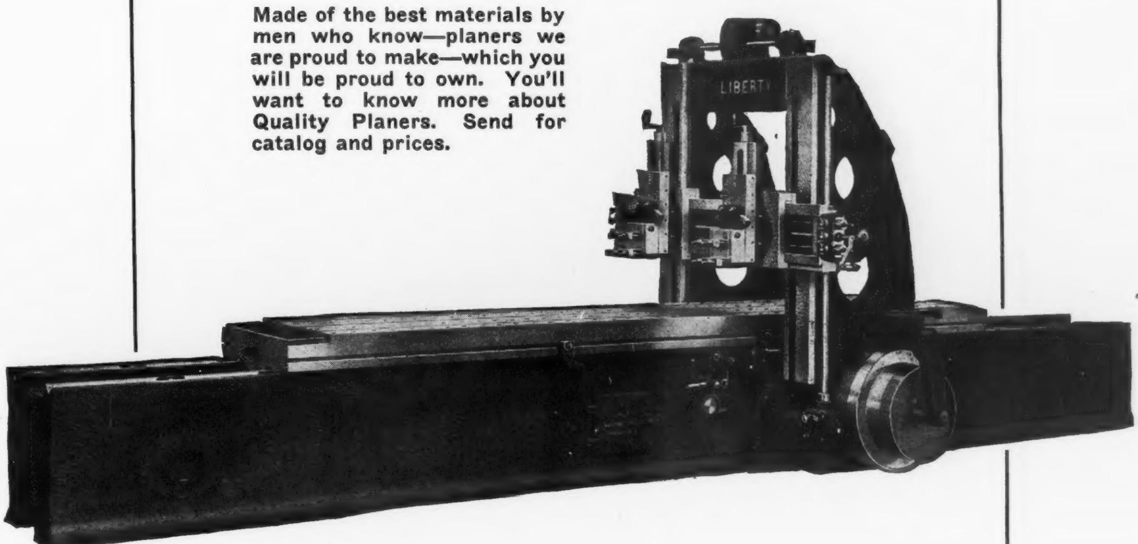
Of course, in a busy shop—and folks with first-class equipment are generally busy—you'll need more planers than this. We have just what you want—the Quality Standard Type Planer!

Quality Planers are powerful and easily operated—are guarded in every way from the possibility of operating errors. The patent feed, the care given to bearings and lubrication, the scientifically correct proportioning and the accuracy and fine finish of each part are points well worth your attention.

THE LIBERTY MACHINE TOOL

Quality Planers

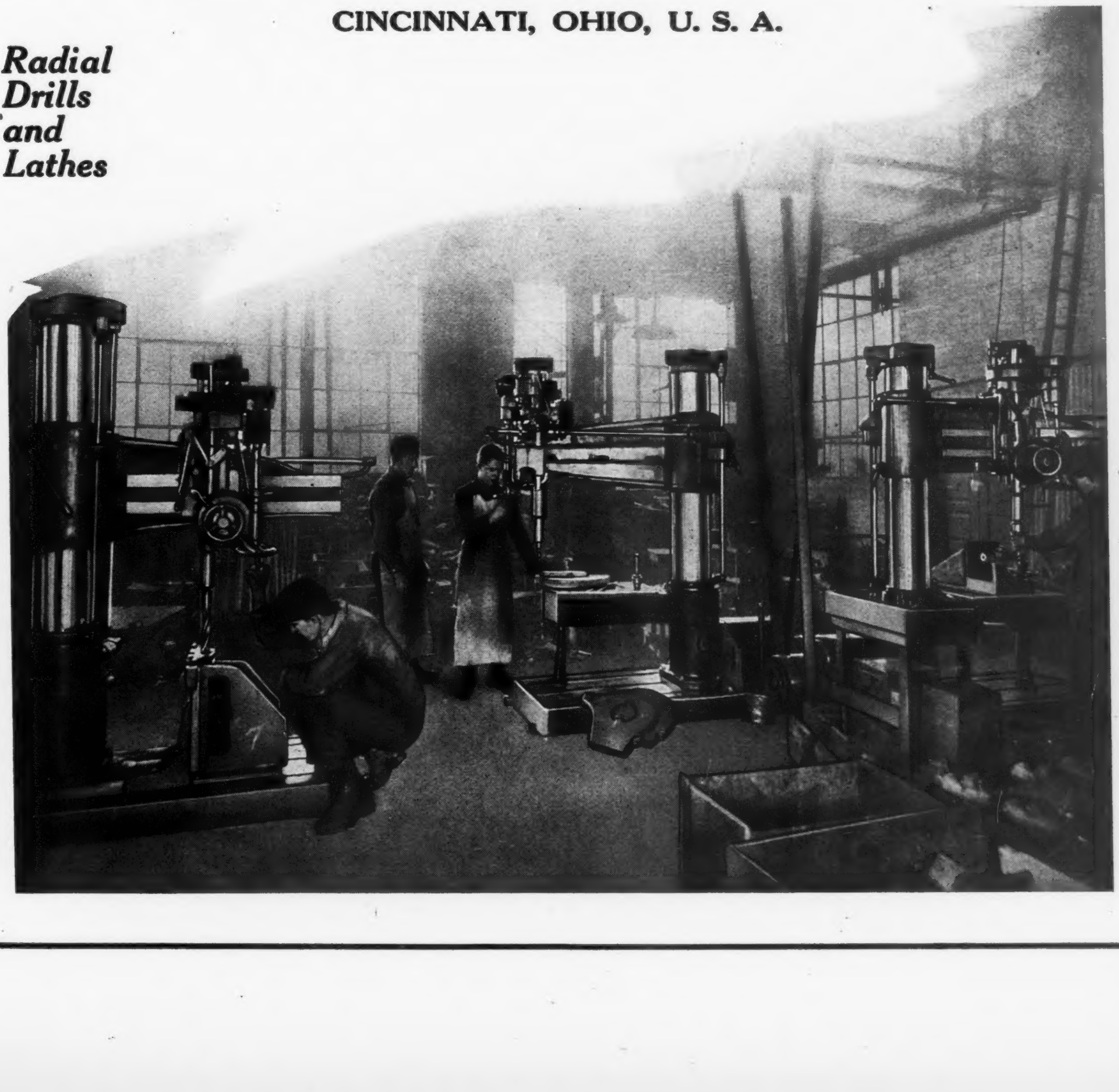
Made of the best materials by men who know—planers we are proud to make—which you will be proud to own. You'll want to know more about Quality Planers. Send for catalog and prices.



Quality Standard Type Planers are made in sizes from 22" to 60", inclusive; Quality Open-side Planers from 24" to 60".

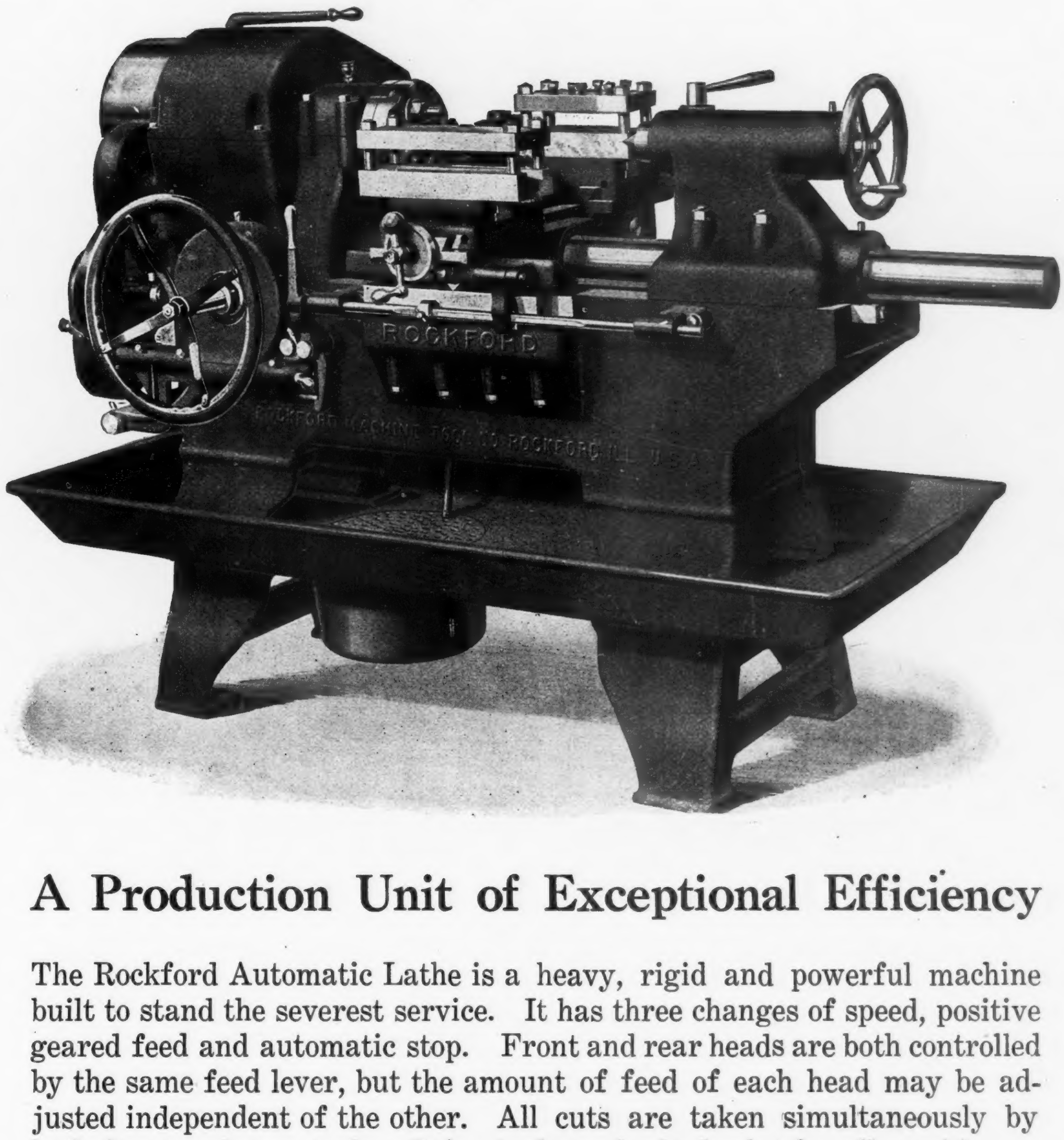
LIBERTY MACHINE TOOLS

COMPANY, Hamilton, Ohio



ROCKFORD

AUTOMATIC LATHE



A Production Unit of Exceptional Efficiency

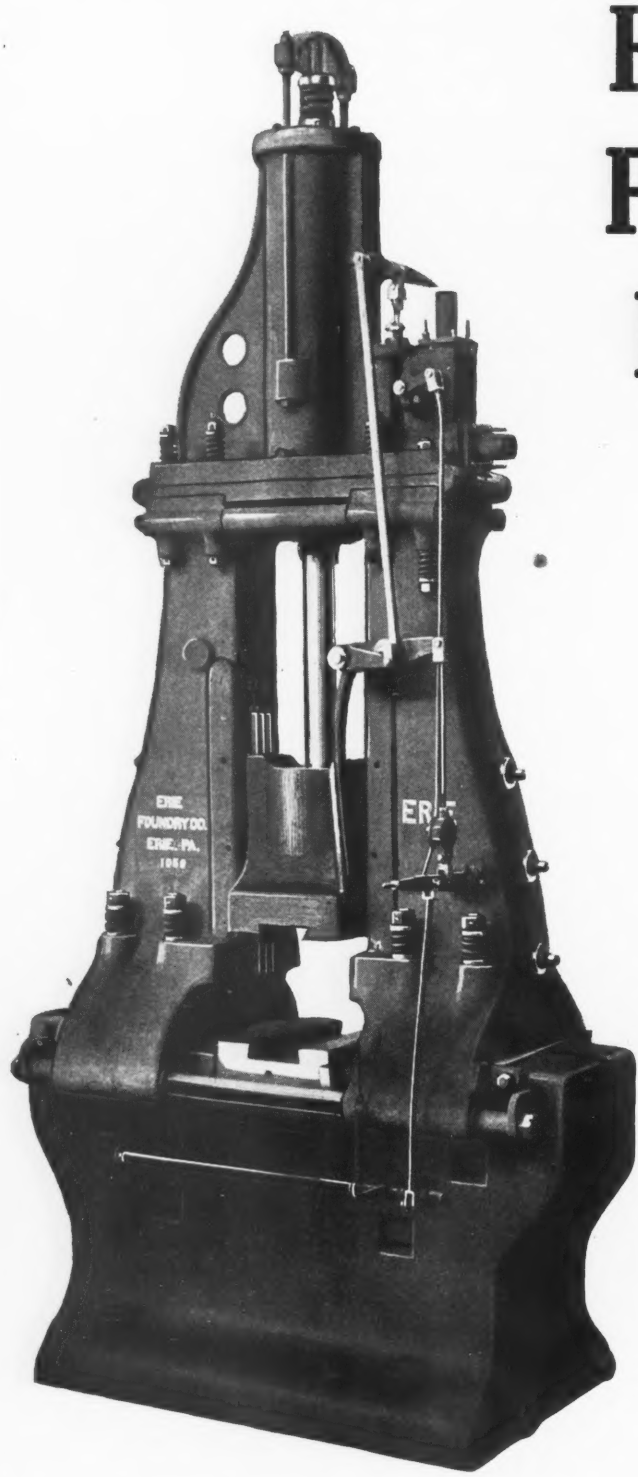
The Rockford Automatic Lathe is a heavy, rigid and powerful machine built to stand the severest service. It has three changes of speed, positive geared feed and automatic stop. Front and rear heads are both controlled by the same feed lever, but the amount of feed of each head may be adjusted independent of the other. All cuts are taken simultaneously by both front and rear tools. Drive is through single clutch pulley with controlling lever in convenient position for operator. Arranged for motor drive if desired. Will swing work 14-in. in diameter and take 18-in. between centers. Let us show you the saving this machine will give you.

Manufactured by

ROCKFORD MACHINE TOOL COMPANY

2400 Kishwaukee St., ROCKFORD, ILL.

VANADIUM STEEL HAMMER PISTON RODS



"We have found from experience and every form of laboratory test that vanadium steel is the best possible material for piston rod purposes."

Erie Foundry Company.

—Write us for facts—

Vanadium Corporation of America

120 Broadway, New York

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Carried in Stock by these Dealers

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E. K. Morris & Co.,	Cincinnati, O.
Wm. McClellan & Co.,	Cleveland, O.
Boyer-Campbell Co.,	Detroit, Mich.
Chas. A. Strelinger & Co.,	Detroit, Mich.
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Cochrane-Bly Co.,	Rochester, N. Y.
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Ludlow & Squier,	Newark, N. J.

For the convenience of our customers we have arranged with dealers in all parts of the country, to carry our complete line. Place your order with the nearest.

FILES ONLY THE BEST ARE GOOD ENOUGH TOOLS

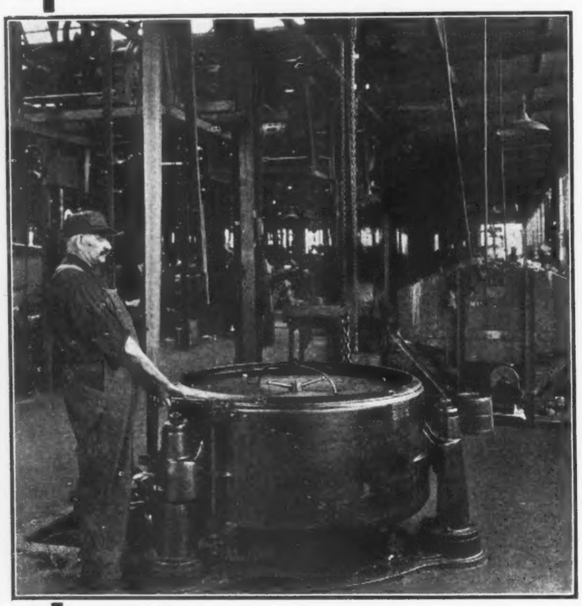
American Swiss File & Tool Company
Elizabethport N. J., U. S. A.

E. P. REICHHELM & CO., Inc.,—Agents
24-26 John Street New York City

Tolhurst Chip Wringers

produce

Dividends From Waste

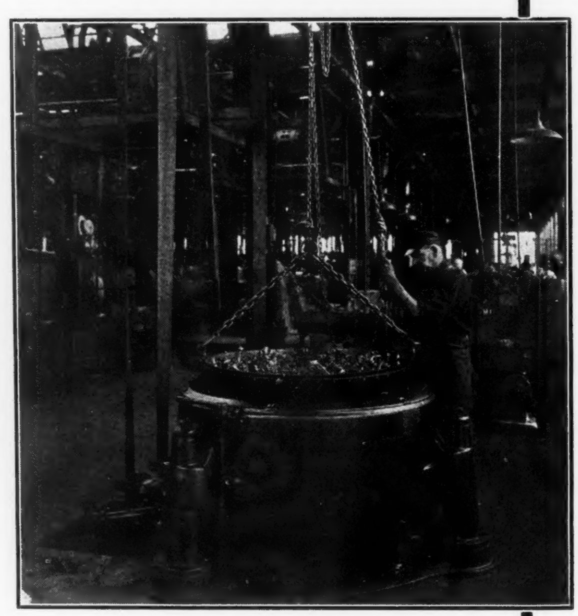


by extracting the cutting oil from steel chips and metal turnings. In doing this they more than pay for their cost; they *turn* loss into profit.

We illustrate the work **Tolhurst** Chip Wringers are doing in the Rolls-Royce of America plant at Springfield, Mass. The upper cut shows a machine in operation; the lower cut shows the basket of metal waste being removed after the oil has been reclaimed.

Tolhurst—Rolls-Royce: two famous names and two great machines.

The **Tolhurst** Chip Wringer is a Centrifugal Extractor designed expressly to reclaim oil and cutting lubricants from chips, turnings and small metal parts. The centrifugal is flexibly slung from three supporting columns, with a revolving basket mounted on large ball and roller bearings. The inner removable basket insures rapid loading and dumping. Baskets of 8.7 cu. ft. and 12.5 cu. ft. capacity care for from 3 to 6 loads per hour. Complete description upon request.



TOLHURST MACHINE WORKS

ESTABLISHED 1852 ***New York Office: 111 Broadway*** **TROY, N. Y.**

Southern Rep.
FRED H. WHITE
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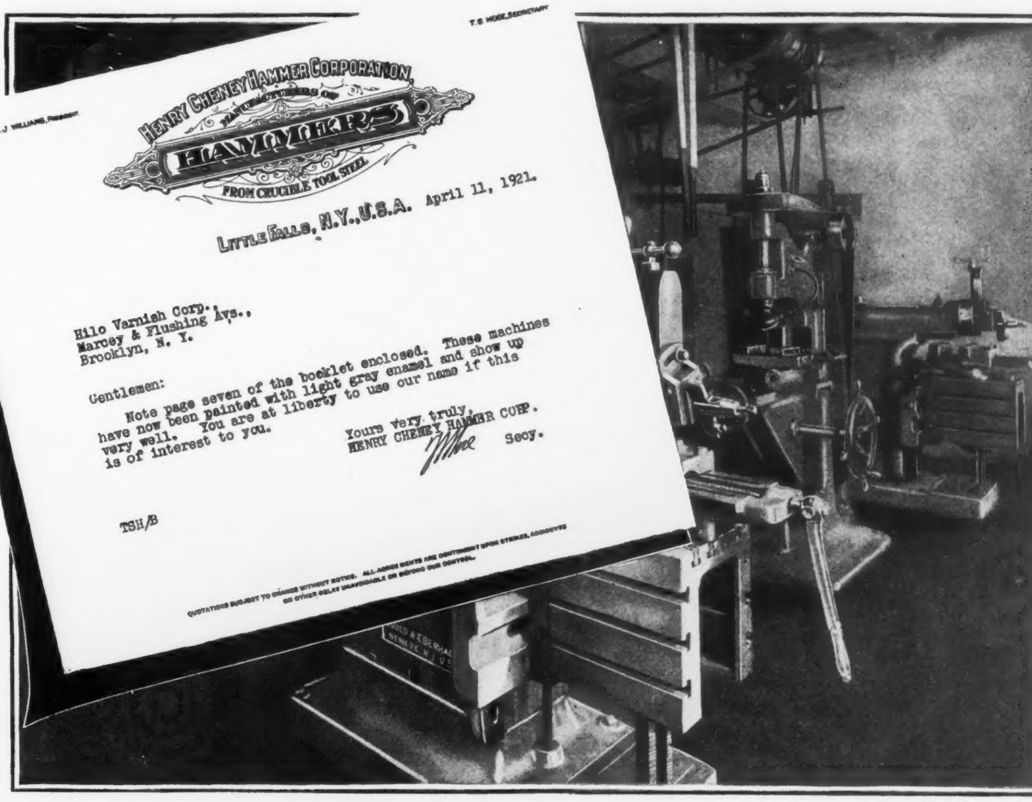
Merchants' Exchange Bldg.,
San Francisco, Cal.

Canadian Rep.
W. J. WESTAWAY CO.,
Main and McNab Sts., Hamilton, Ont.;
400 McGill Bldg., Montreal, Canada.



"Lite-Gray" on your Machines appeals to customers

Right now when manufacturers are bending every effort to strengthen the saleability of their tools, Hilo "Lite-Gray" is proving its case one hundred per cent. This modern machinery enamel brightens up the machine, giving it distinction and placing it in a class by itself on the sales floor.

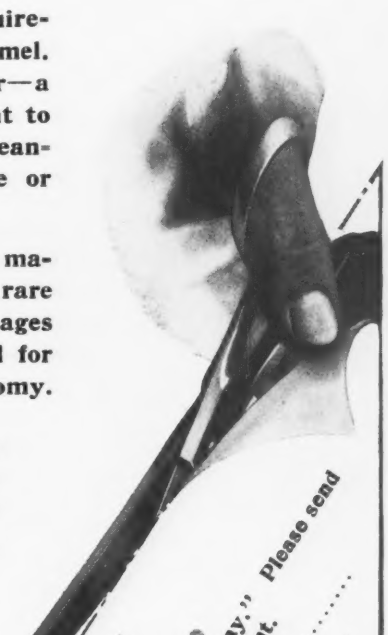
Hilo "Lite-Gray" increases the value of the machine itself.

It helps the operator work more steadily, because its light surfaces avoid eye-strain, it makes set-up jobs simpler and duplicate-production work less monotonous to the operator.

"Lite-Gray" answers every requirement of a modern machinery enamel. It does not lose its light color—a special process makes it resistant to oils and grease, and permits the cleaning of its surfaces with gasoline or benzine.

Try out Hilo "Lite-Gray" on your machines. The present slack offers a rare opportunity for testing its advantages—both for its sales-features, and for its influence on production economy.

There is a coupon attached for your convenience. Tear it out and mail RIGHT NOW before it slips your mind.



HILO VARNISH CORPORATION

Makers of Varnish and Enamels Since 1863

Marcy and Flushing Aves.
Brooklyn, N. Y.

2420-24 Washburne Ave.
Chicago, Ill.

"Lite-Gray" HILO

HILO VARNISH CORPORATION
Brooklyn, N. Y.

Gentlemen:
We are interested in "Lite-Gray." Please send us a free sample for our experiment.

FIRM..........................

ADDRESS..........................

By..........................

M.A.

"OLIVER OF ADRIAN"

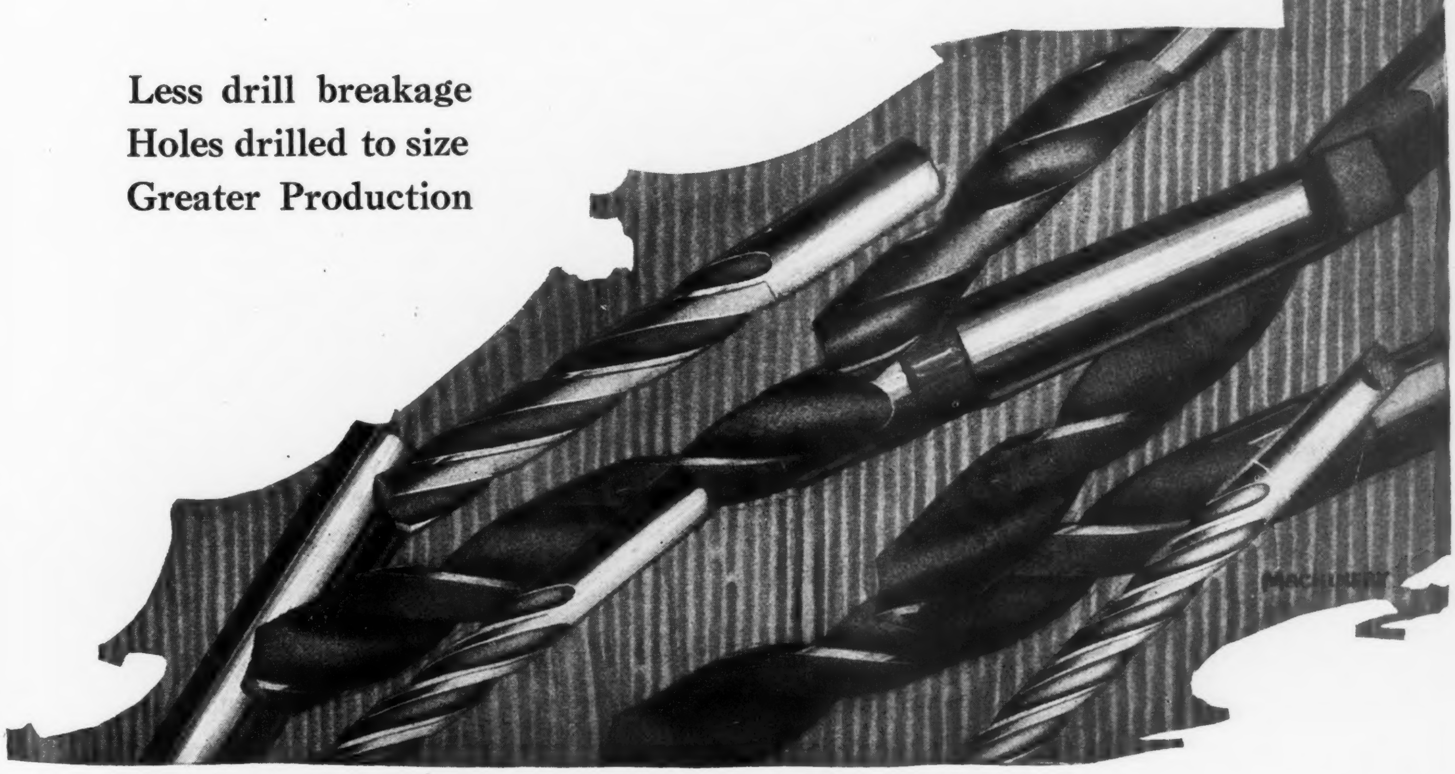
TWIST DRILL GRINDER

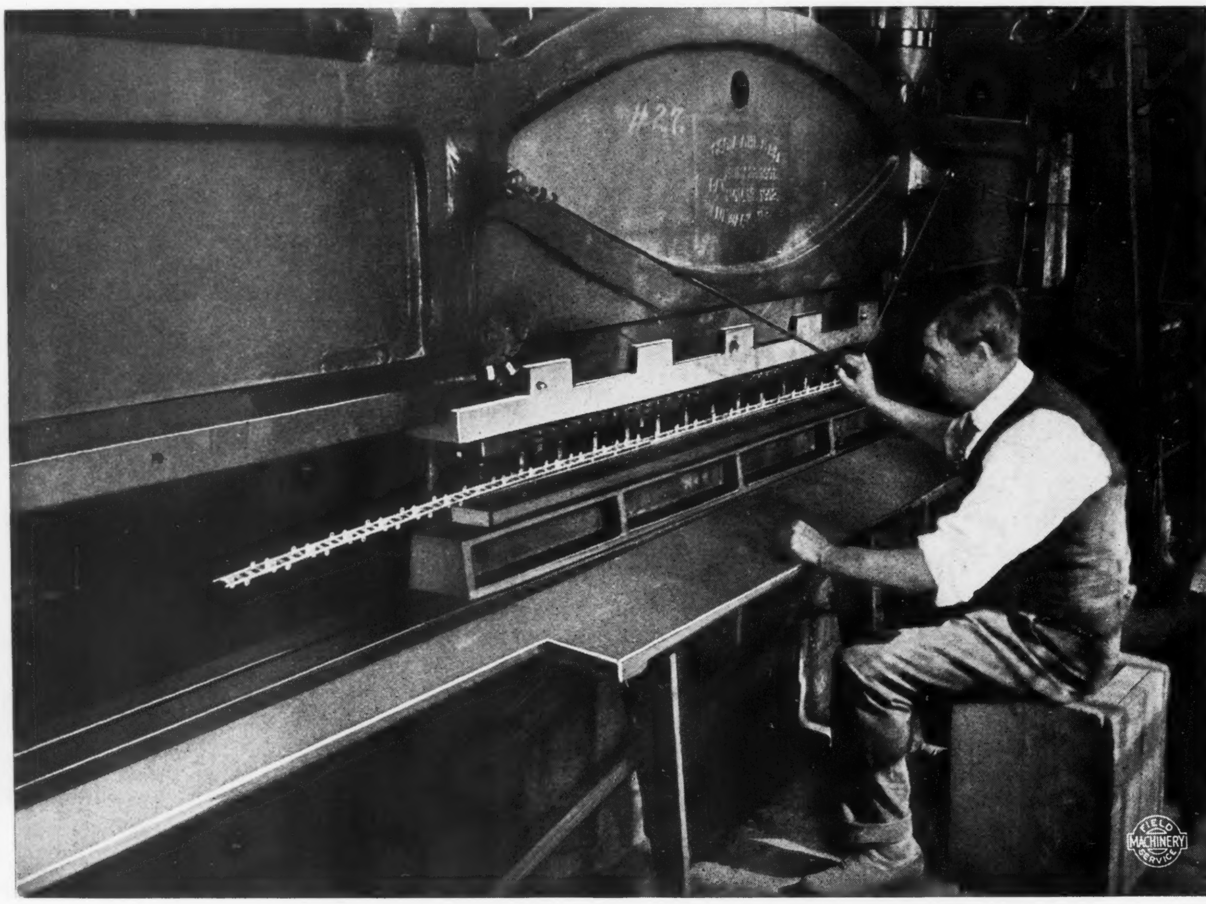
THE New Oliver Drill Grinder is devoid of complications, adjustments, uncertainties—it is equally satisfactory with two-, three- or four-lip drills.

Every point is accurately sharpened independent of the skill of the operator. The lips are ground alternately. The drill revolves automatically. The clearance is always uniform and increases properly toward the center. The lips are always of the same length. The lips are slightly relieved in front of the cutting part of the chisel point producing a freer cutting drill.

Every movement of the New Oliver Twist Drill Grinder is properly timed; it is fool-proof, its accuracy predetermined. Best of all, whatever type, size or style of drill is sharpened its operation is automatic from start to finish. Two styles —belt drive or individual motor drive. See the New Oliver of Adrian Twist Drill Grinder in operation if you can. If you can't write for explanatory booklet.

Less drill breakage
Holes drilled to size
Greater Production




FIELD
MACHINERY
SERVICE

COLONIAL TOOL STEELS

for every tool making purpose

Chipping out all the inevitable seams in the billets is one of the precautions that keeps up the quality of the Tool Steels made in the Colonial mill.

Eliminating Tool Steel Breaks Before They Occur

No. 6 of a series of advertisements describing the production of Colonial Tool Steels.

AN ENTIRE DEPARTMENT in the Colonial Mill is devoted to removing seams and surface defects in billets. Each billet is critically examined, every imperfection marked with white paint, then chipped out and ground down to the solid perfect steel.

No seams are left for the finishing rolls to conceal; possible breaks in your tools are eliminated before they occur. It is an example of care, of the rigid adherence to quality standards, in every step in the making of all Colonial Tool Steels.

This Chipping Department is really yours, it belongs to every Colonial customer; it produces nothing for us directly—the one task it shoulders is to eliminate possible difficulties for you.

And this department pays a profit to the users of Colonial Tool Steels—it is a means of assurance of care-free, dependable work in your plant.

LIST OF TOOLS
and Grades of Colonial Steel adapted for their use

Name of Tool	Grades of Steel
Arbors	Red Star
Augers, Wood & Bits	Red Star
Axe	Red Star
Ball Bearings	Superior
Bits, Channeling Machine	Red Star
Bits, Coal Mining	Anchor
Bits, Tong	Red Star
Bits, Well Stone Drilling	Standard Well Bit
Bush Hammer, Stone Tools	Red Star Sheets
Bunter, Heading	Red Star
Broaches, Machine	No. 7, High Speed
Bushings	Red Star
Center Punches	Red Star
Center, Lathe (see L)	Red Star
Chasers, Threading	H. S., No. 7, No. 14
Chain, Pipe, Links	Vanadium, Type A
Chisels, Pneumatic	No. 7
Chisels, Hand	Red Star
Chisels, Stone Cutters	Red Star
Chisels, Wood Working	Red Star
Cupping Tools	Red Star
Caulking Tools	Red Star
Claw Bars	Red Star
Creasers, Hot	H. S., No. 7 E
Counterbores	H. S., No. 14
Counterbores, Solid, Interchangeable	H. S., No. 7, No. 14
Collets, Bit Brace	Red Star
Collets, Spring	Red Star
Cutters, Fine Finishing	No. 5
Cutter, Pipe	H. S., No. 14
Cutters, Flue	No. 7, High Speed
Cutters, Flue Hole	No. 7
Cutters, Nail	High Speed
Cutters, Corn Stalk	Alto Sheets
Cutters, File	High Speed
Cutters, Milling, Plain	High Speed
Cutters, Form	High Speed
Cutters, Inserted Blade	High Speed
Cutters, Profile	High Speed
Cutters, Metal Slitting	High Speed
Cutters, Screw Slotting	No. 5
Cutters, Wood Forming	High Speed, No. 5
Cutting off Tools	High Speed
Dies, Bolt Threading	H. S., No. 7, No. 14
Dies, Blanking	H. S., No. 7, No. 14
Dies, Forming & Bending	No. 7, No. 14
Dies, Sub-Press	No. 7, No. 14
Dies, Drawing	H. S., No. 7, No. 14
Dies, Cartridge Shell	High Speed, No. 7
Dies, Hammer Dies, Power	Red Star
Flat Jack Jewelers' Dies	High Speed No. 7
Dies, Drop Forging	Red Star, Alto
Dies, Nail	High Speed
Dies, for Paper	H. S., No. 14
Dies, Pipe Threading	H. S., No. 7, No. 14
Dies, Solid & Adjustable Threading	H. S., No. 7, No. 14
Dies, Glove	No. 7, No. 14
Dies, Rivet	No. 7, Red Star
Dies, Shoe Knife	Red Star
Dies, Spring Screw, Threading	H. S., No. 7, No. 14
Dies, Solid Bolt	No. 7, No. 14
Dies, Adjustable, Round	
Dies, Split Threading	H. S., No. 7, No. 14
Dies, Spoon, Silver	No. 14
Dies, Silversmith	No. 7
Dies, Domino Screw Cold Heading	No. 7, Red Star
Dies, Cold Heading	No. 7, Red Star
Dies, Hot Heading	H. S. or No. 35
Dies, Wire Drawing	No. 14
Dies, Plates	No. 7, No. 14
Digging Bars	Red Star
Drills for Boring	Red Star
Drills, Tool Steel	H. S., Superior
Drills for Stone	Red Star
Drills, Twist	High Speed
Drills, Flat	High Speed
Engraver Tools	No. 14
Furnace Bars	Anchor
Flatters, Blacksmiths	Red Star
Fullers, Blacksmiths	Red Star
Forming Tools for Metals	H. S., No. 5, No. 14
Flange Tire Forming Tools	High Speed
Gear Cutters	High Speed
Gauges	Oil Hardening No. 6
Grip Dies for Rivets, Hot	No. 35
Hatchets	Red Star
Hammers, Blacksmiths	Red Star
Hammers for Crushing Machines	Red Star
Hammers, Pneumatic	No. 7
Hammers, Nail Machines	No. 7
Hammers, Riveting Pneumatic	No. 7
Hobs, Gear	H. S., No. 7, No. 14
Header Dies, Cold	No. 7, Red Star
Header Dies, Hot	No. 36

Name of Tool	Grades of Steel
Jaw Chuck	Imperial
Jaw Vise	Imperial
Keys for Drop Hammers	Red Star
Knives, Pocket	Red Star Sheets
Knives, Carver	Red Star Sheets
Knives, Butcher	Red Star Sheets
Knives, Cleavers	Red Star Sheets
Knives, Back Spring	Alto Sheets
Knives, Heel Forming Shoe	No. 14
Knives, Shoe Makers	Red Star Sheets
Knives, Shoe Sole	Red Star
Knives, Surgical	No. 14
Knives, Table	Alto Sheets
Knives, Potato	Alto Sheets
Knives, Corn Knife	Alto Sheets
Knives, Drawing	No. 14, Red Star
Knives, Hog	No. 14
Knives, Machine	H. S., Red Star
Knives, Paper	H. S., or No. 14
Knives, Shear	No. 7, Red Star
Knives, Wood Working	H. S., Red Star
Knurling Tools	No. 7, No. 14
Lathe Centers, Dead	Red Star
Lathe Center, Live	Red Star
Lathe Tools for Metal Turning	High Speed
Lathe Tools for Woodworking	High Speed
Liners for Brick Dies	Imperial
Letter Stamps, Hand	No. 7, No. 14
Letter Stamps, Roll	No. 7, No. 14
Mandrels	Red Star
Mills, End	High Speed
Mills, Hollow	High Speed
Mills, Shell End	High Speed
Piercers, Hot	High Speed
Pick Steel	Alto
Pinion Bars	Red Star
Pins, Drift	Red Star
Pinch Bars	Red Star
Planer for Metal Tools	High Speed
Planer for Stone	High Speed
Planer for Wood	Red Star
Point Steel for Stone Cutters	Red Star
Punches, Cartridge Shell	No. 7
Punches, Hand—Hot or Cold Work	H. S., or No. 7
Punches, Drawing	No. 7, No. 14
Plug Gauges	No. 6, Oil Hard'ng
Pneumatic Tools	No. 7E or F
Reins, Tong	Red Star
Rods, Piston	Red Star
Reamers, Hand, Solid	H. S., or No. 5
Reamers, Shell	High Speed
Reamers, Taper	High Speed
Reamers, Rose, Chucking	High Speed
Reamers, Locomotive, Taper	No. 14, H. S.
Reamers, Bridge	High Speed
Reamers, Expansion, Hand	High Speed
Reamers, Drill & Center	No. 5
Rolls, Flue Expanding	No. 7
Ring Gauges	No. 6, Oil Hard'ng
Rivet Sets	No. 7, Red Star
Shear Blades—Hot Work	H. S., No. 7
Shear Blades—Cold Work	No. 7, Red Star
Saws, Circular Metal	H. S., Nikro
Saws, Circulzr Wood	Nikro
Scrapers for Scraping Machine Parts	No. 5
Serapers, Tube	Red Star
Screw Drivers	Red Star
Set—Rivet	No. 7, Red Star
Sets—Button	No. 7, Red Star
Sets—Nail	Red Star
Splining Tool	High Speed
Shaper Tool	High Speed
Stamping Tools	No. 7, No. 14
Sledges, Blacksmith & Stone	Red Star
Snaps, Rivet	No. 7, Red Star
Springs	Red Star
Swages, Blacksmith	Red Star
Swaging Metal	No. 7
Taps, Tapper	No. 14, Red Star
Taps, Hand	Red Star Tap, Extra No. 14
Taps, Machine	H. S., Red Star
Taps, Automatic Machine Screw	High Speed, No. 7
Taps, Staybolt	No. 14
Taps, Pipe Taps	Red Star
Taps, Pipe Tap Chasers	High Speed, No. 7
Tire Turning	High Speed
Tool Holder Bits	High Speed
Wedge, Stone	Red Star
Wedges	Red Star
Wrenches, Track	Red Star

Full instructions for hardening and tempering all Colonial Tool Steels will be found in the *Colonial Heat Treating Book.* MAILED FREE.

Colonial Steel Company

PITTSBURGH TOLEDO BOSTON DETROIT NEW HAVEN CHICAGO NEW YORK ST. LOUIS CLEVELAND

WE make and carry them, little and big, straight and bent, thick and thin—over 40 standard patterns in 1000 sizes of Superior Drop-Forged Wrenches. Ask your dealer.

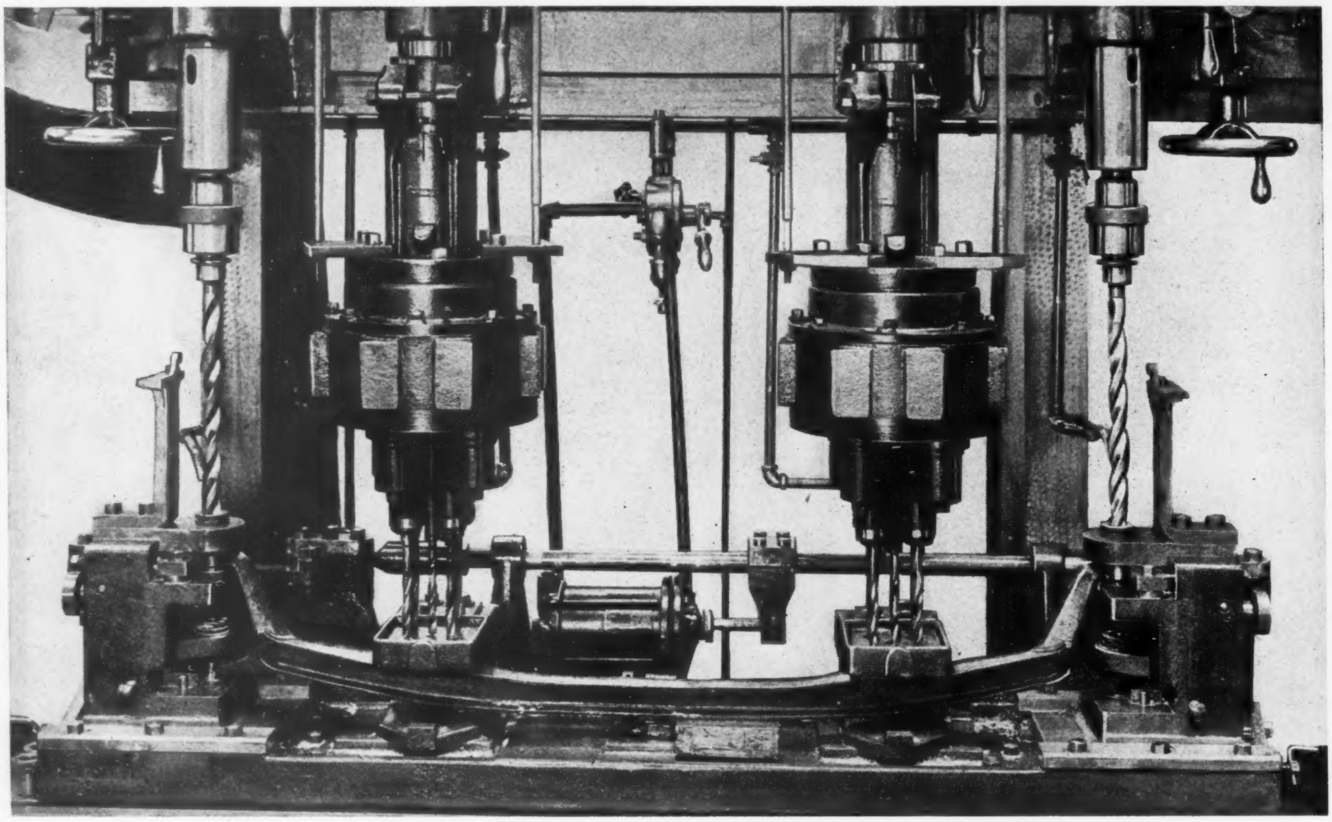
Wrench Book on request

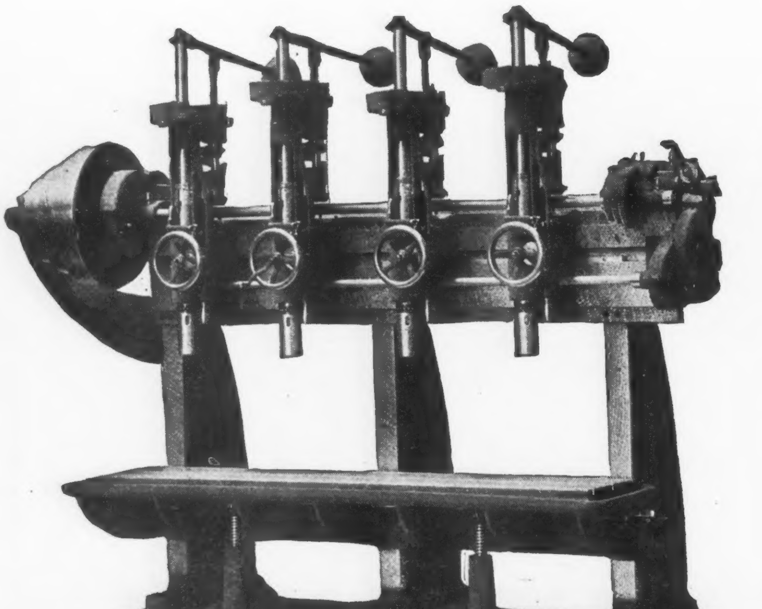
J. H. WILLIAMS & CO.

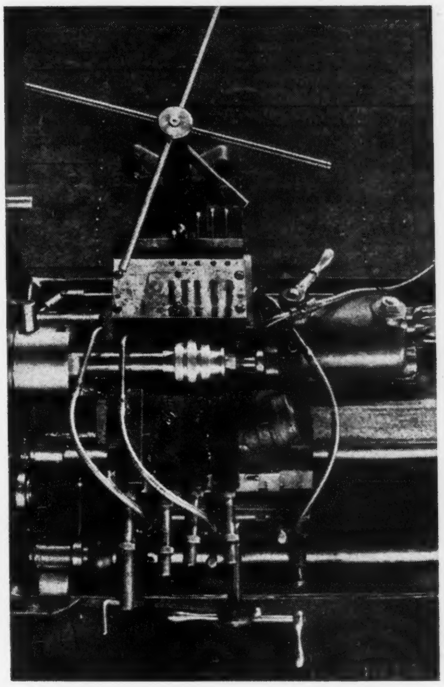
"The Wrench People"

BROOKLYN	BUFFALO	CHICAGO
61 Richards St.	61 Vulcan St.	1061 W. 120 St.

St. Catharines, Ontario

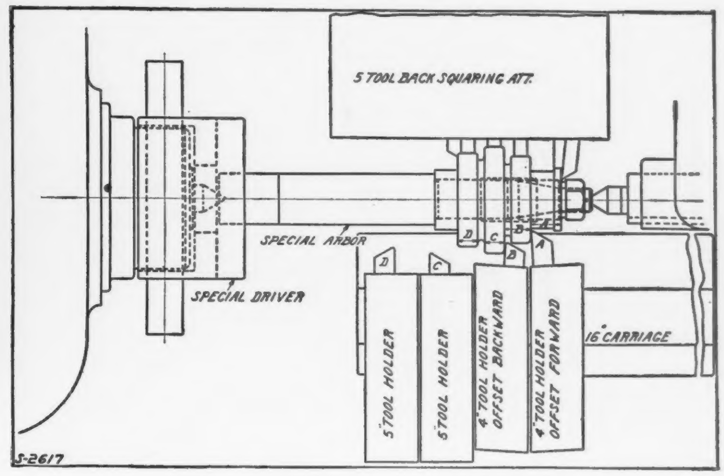






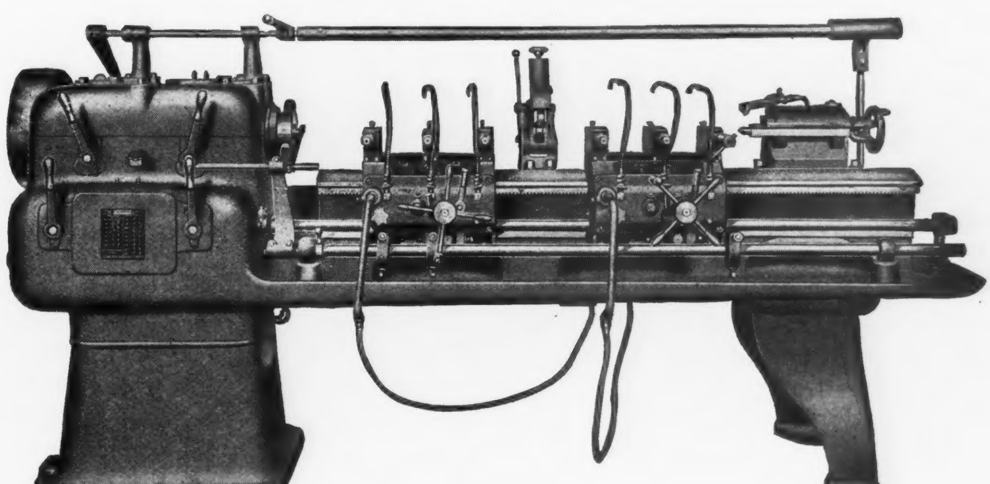
Lo-swing

Automatic Back Squaring Attachment



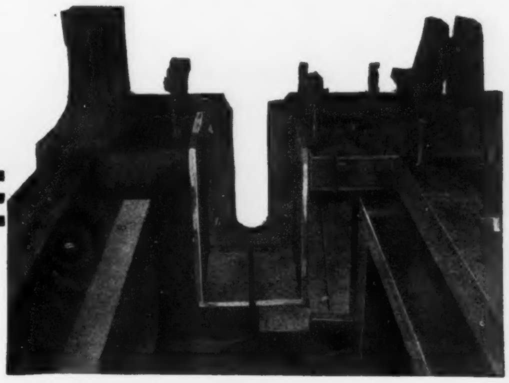
By use of the familiar Lo-swing principle of multiple tools cutting simultaneously applied to the back of the lathe the ends and shoulders of this cluster gear are squared and formed at the same time that all diameters are turned by tools mounted on the regular carriage, operating from the front. Piece is finished from rough stock at one setting in the lathe.

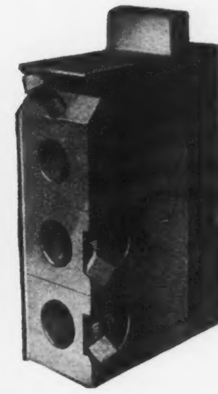
Send us drawings of similar work for production estimates.



Fitchburg Machine Works, Fitchburg, Mass.

REPRESENTATIVES: Detroit and Cleveland District, W. H. Nettle, 236 Richton Ave., Highland Park, Detroit, Mich. Chicago, Milwaukee and St. Louis District, W. A. McCarrell, 429 Kenwood Boulevard, Milwaukee, Wis. Southern Continental Europe, G. E. Fogarty, 42 Rue de Peletier, Paris 9e, France. Northern Continental Europe, O. Ericsson, Axelborg, Copenhagen B, Denmark. British Isles, Buck & Hickman, Ltd., 2 and 4 Whitechapel Rd., London E 1, England.





Forging Machine Capacity

The capacity of a forging machine is determined by its space to accommodate work and its ability to accomplish work; in other words, its *DIE AND TOOL SPACE and POWER.*

AJAX

(Trade Mark Registered)

New Model Upsetting Forging Machines

possess these two factors in proportions never before equaled.

Their unusual Die Height and Length, which are completely utilized by the fully adjustable Triple-high Tool-holders, and their great Stock Gather make it possible to complete the largest and most intricate upset forgings with a minimum number of heats and die changes.

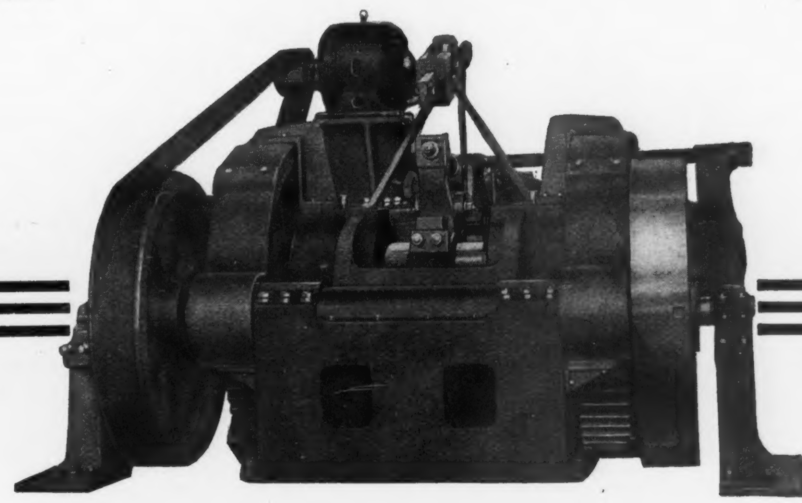
Their Twin Gear Drive with twin fly wheels applies power to both ends of the crankshaft, and the Ajax Drop Lock makes it possible to utilize the momentum of the rotating crankshaft and pitman, delivering working power equal to the hardest forging job.

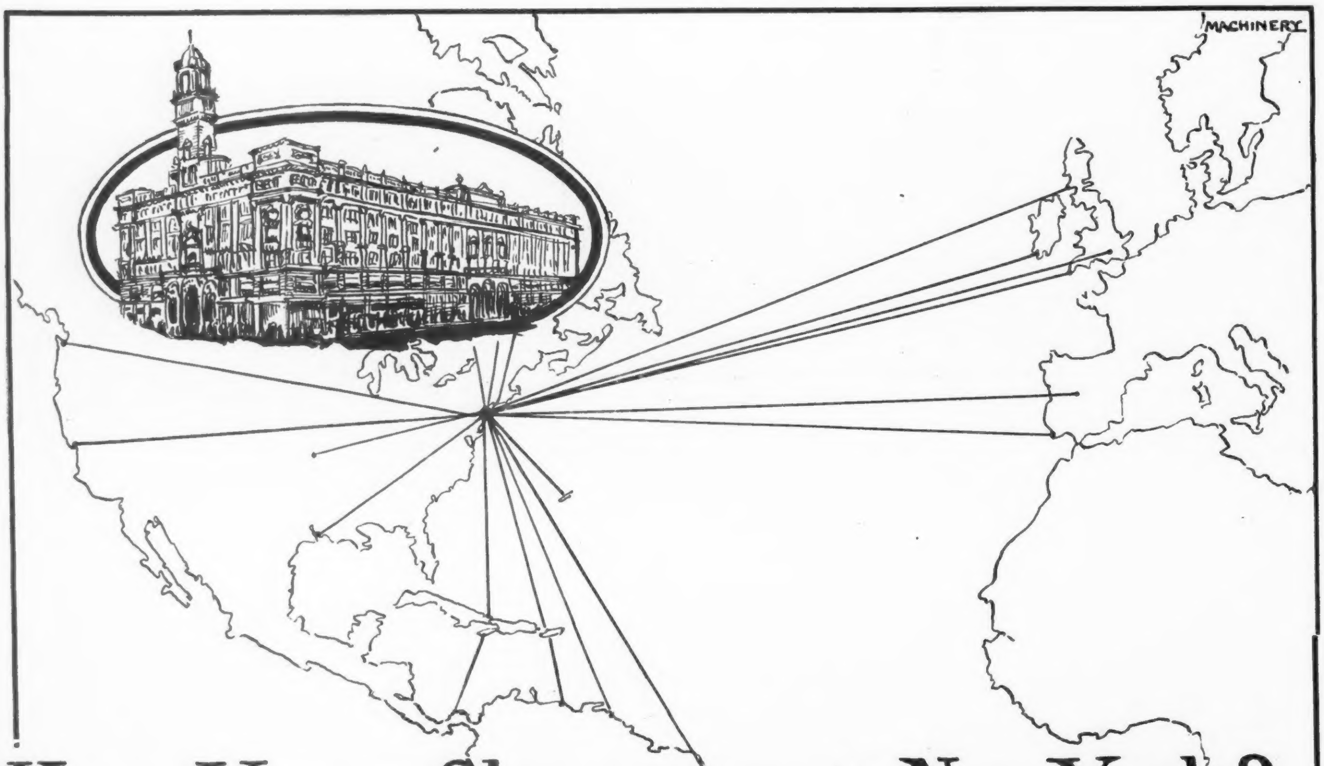
THE AJAX MANUFACTURING COMPANY

1369 Hudson Terminal
NEW YORK CITY

Cleveland, Ohio

621 Marquette Building
CHICAGO, ILL.





Have You a Showroom in New York?

Commercially, New York is the hub of the universe. From Europe, from South America, from all sections of our own country buyers come to New York to trade.

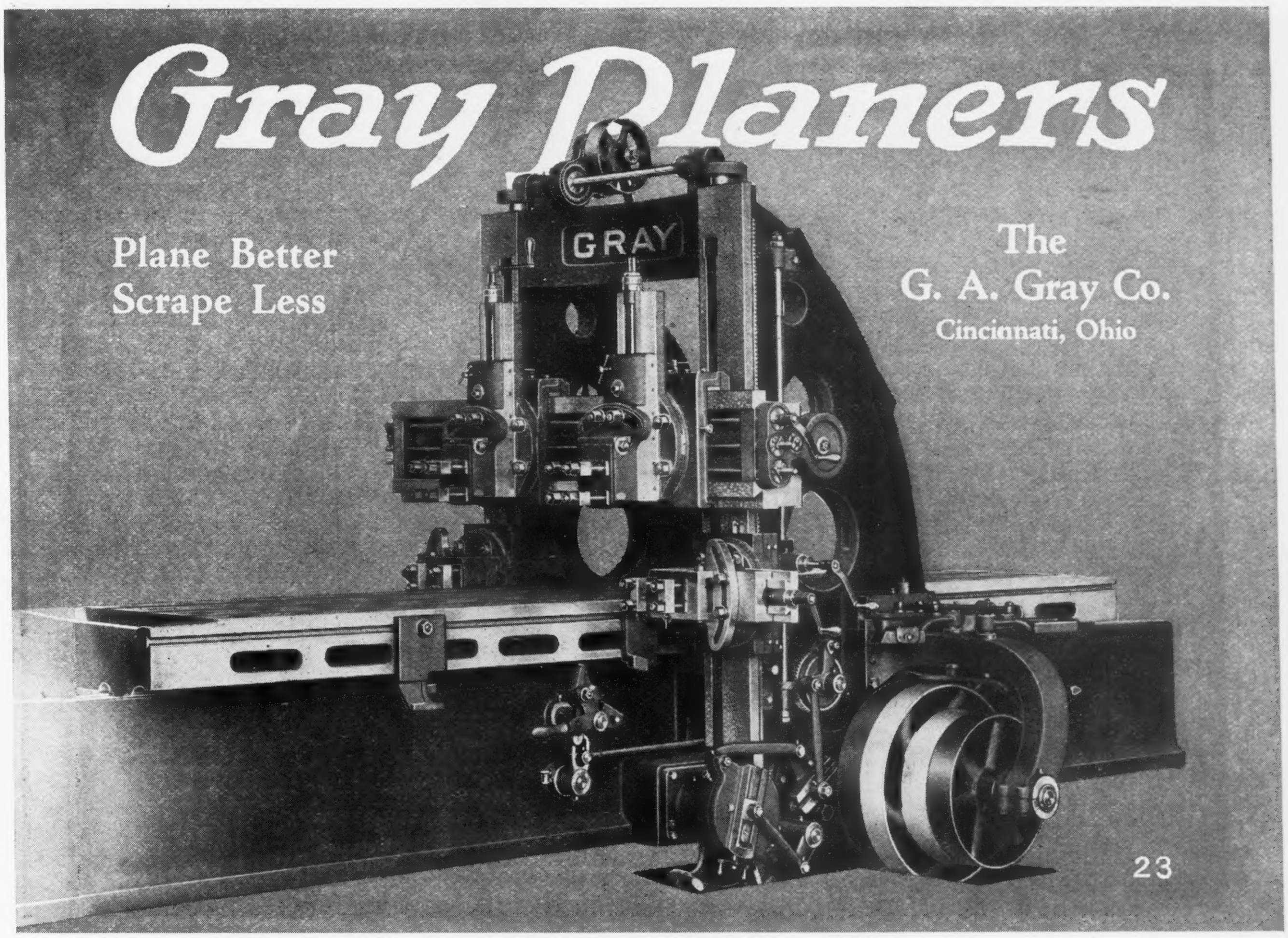
A showroom here is a business asset you can't afford to overlook—and you can easily have it.

Our building is centrally located—within easy reach of all railway and shipping terminals. Subways and other local transportation routes at the door. We can offer you unparalleled service facilities, any sized space you need—floor space covers approximately 170,000 square feet—in sections laid out from 150 square feet, up—power for demonstration purposes, and attendants ready to give information about your products, note inquiries and promote your interest in every way. Rentals are low and include light, heat, janitor service, etc. No need to keep a special man on the job. We forward notice of all inquiries to your nearest representative, or direct.

We solicit permanent exhibits of all classes of Machinery, Machine Tools, Accessories and Mechanical Appliances. Make your selection while some of the choicest locations are still available. Floor plans, circulars and further details on request.

Manufacturers' Exhibition Company, Inc.

45 West 18th Street (corner 6th Ave.,) NEW YORK CITY

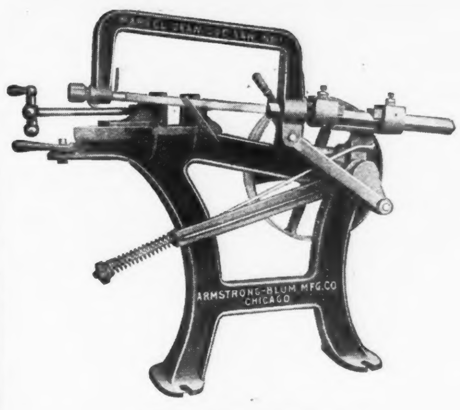


Have you a good Hack Saw in your shop?

Marvel Hack Saws

Are built right. They bring RESULTS. The two shown here are general work saws. Both have quick action vise. Both have a device for raising the saw frame above the work and holding it in that position, allowing free use of both hands in measuring and adjusting the material to be sawed.

The Price is Low

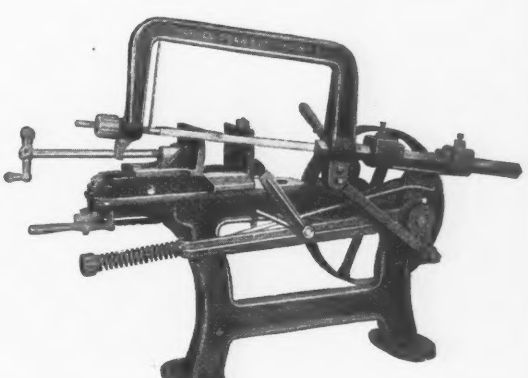


Marvel Hack Saw No. 1

The Marvel Hack Saw No. 1 has a capacity of 4" by 4", the length of blade is 12". The Marvel Hack Saw No. 2 has a capacity on the long stroke of 6" by 6", on the short stroke of 8" by 8" and takes saw blades from 12" to 17".

We also make the MARVEL high-speed hack saws, the highly improved No. 8 metal band saw, and a line of lever punches, shears, rod cutters, and drill press vises.

Send for the Marvel Catalogue



Marvel Hack Saw No. 2 with Swivel Vise

ARMSTRONG-BLUM MFG. CO.

343 N. Francisco Avenue

CHICAGO ILLINOIS, U. S. A.

Twist Drills
Reamers

Gear and Milling Cutters

"Tools You Buy Again"

UNION

Union Twist Drill Company

DRILL AND CUTTER MAKERS

ATHOL, MASS., U. S. A.

NEW YORK CHICAGO

Heat-Treated +!

HEAT-TREATED not in the common, collective sense, but heat-treated according to size and individual form.

Not only is every "Allen" case hardened to give the hardest and deepest "case" around a tough core, but each *diameter* of screw is differently treated.

Going still further, each different style *point* is individually treated:—flat, oval, dog, cup, cone —hardened for the stresses peculiar to each.

When you do all this on top of the Allen process of *cold-drawing the sockets,* you have the supreme article in a set screw—easily 30% stronger than any other hollow set screw made.

There's only one object in making the "Allen" so good:—economy to you, the buyer. Economy in length of service, economy in fewer replacements, economy in your mechanics' time.

A booklet illustrating the Allen process, with complete price list of the screws, will be mailed you in time to make these savings on your next purchase. Write—

THE ALLEN MFG. CO.

125 Sheldon Street, Hartford, Conn.

Pacific Coast Branch Office: The Charles A. Dowd Sales Co., 320 Market Street, San Francisco, Calif.

Announcing an Addition to the Fosdick Line

THE

FOSDICK

TRADE MARK REG. U.S. PAT. OFF.

(Formerly the PIERLE)

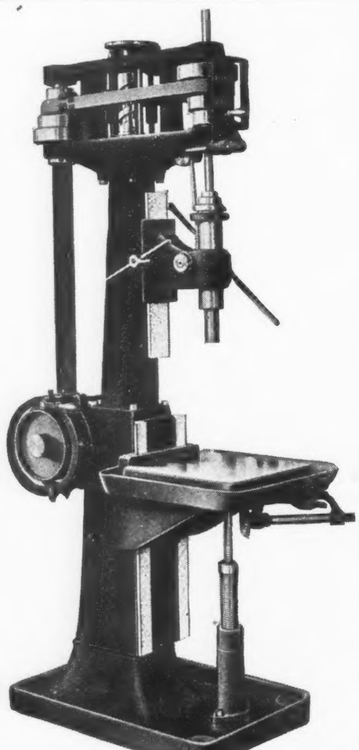
Patented

High Speed Ball Bearing Sensitive Drill

with

Spiral Gear Drive

Built in All Combinations
One to Eight Spindles
16" Swing (8" Overhang)
and
24" Swing (12" Overhang)



These well-known drills are now built in the same high standard of excellency which has made the FOSDICK Uprights and Radials famous throughout the world.

An Advanced Engineering Design

This line of HIGH-SPEED DRILLS represents developments far ahead of general practice in building machines for rapid, accurate drilling operations met in general manufacturing.

Many factors in the design contribute greatly to this result.

We are ready to submit for your careful engineering analysis, descriptive circulars, fully illustrated, and complete specifications.

Remember, our engineering department is ready to solve your drilling problems.

THE FOSDICK MACHINE TOOL CO., Cincinnati, Ohio, U. S. A.

4, 5 and 6 Foot Heavy Duty Radials

Several styles table and drive available—all interchangeable. Let us tell you all about them.

FOSDICK

A Name Associated for More than 33 Years with the Most Advanced and Efficient Drilling Practice.

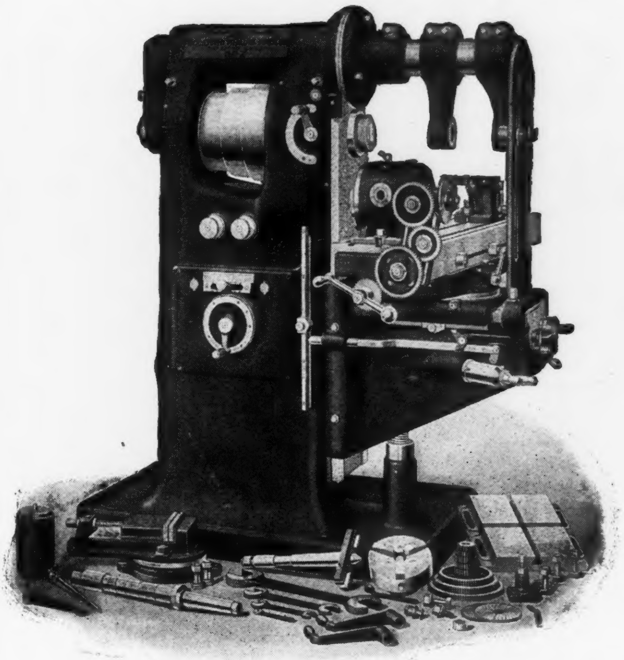
From the heavy, full ribbed base to the large annular and thrust bearings which cap its double tubular type column, quality and convenience are apparent in every feature of this heavy duty radial.

Wide range of cutting speeds with only one speed at the pulley provide for drilling up to 3" and heavy boring; ball bearings are liberally used throughout; feed and speed boxes are each controlled by a single lever and powerful tapping reverse frictions are mounted on the sleeve and run in oil.

THE FOSDICK MACHINE TOOL CO., Cincinnati, Ohio, U. S. A.

AGENTS: Biggs-Watterson Co. Cleveland, Ohio. Colcord-Wright Mchy. & Supply Co., St. Louis, Mo. Eccles & Smith Co., San Francisco, Cal., Los Angeles, Cal., Portland, Ore. Barbour, Love & Woodward, Inc., New York City. E. A. Kinsey Co., Cincinnati, Ohio, Indianapolis, Ind. Homer Strong, Rochester and Buffalo, N. Y. Peninsular Machinery Co., Detroit, Mich. H. A. Smith Machinery Co., Syracuse, N. Y. Swind Machinery Co., Philadelphia, Pa. (Somers, Fitler & Todd Co., Pittsburgh, Pa. Radials only.) (Thompson Machinery Co., Pittsburgh, Pa. Uprights only.) Stocker-Rumely-Wachs Co., Chicago, Ill., Milwaukee, Wis. Taylor Machinery Co., Boston, Mass. A. R. Williams Machinery Co., Ltd., Toronto, Ont., Canada. Burton, Griffiths & Co., Ltd., London, England. Fenwick Freres & Co., Paris, France. Wynmalen & Hausmann, Rotterdam, Holland. Rylander & Asplund, Stockholm, Sweden. Wilh. Sonneson & Co., Malmo, Sweden, Copenhagen, Denmark. Alfred Herbert, Ltd., Tokyo, Japan.

Rockford No. 2 Heavy Duty Milling Machines



Famous for the Solid Steel Arm, Extra Convenience and Unusual Versatility

Many of the advantages of these machines can be seen at a glance—for example, the overhanging arm, reinforced by our patented flanged support; the heavy box type knee with extended top on the column and extra long bearings; the unusual depth of the table and the location of all controls within convenient reach of the operator as he stands at his work.

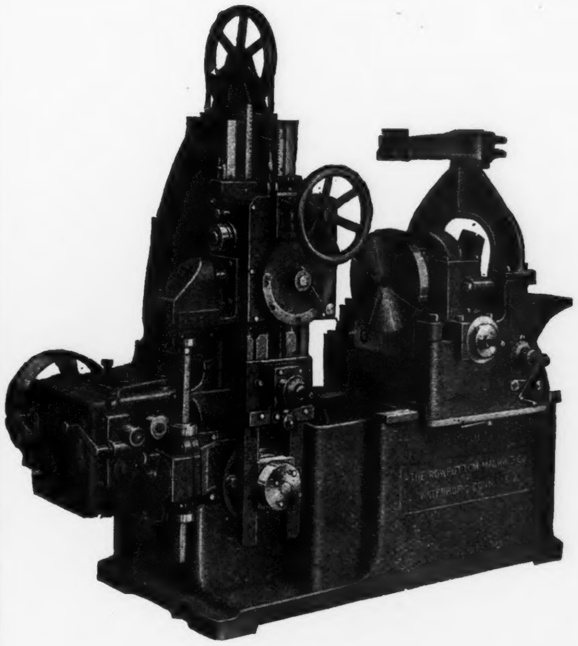
Eighteen spindle speeds are obtained through double back gears placed close together inside the column at the front of the machine; fourteen feed changes are obtained through cut steel gears without change gears. Table presents a working surface 50″ by 11½″; swivels 290°; travels 28″ longitudinally, 9″ transversely and has 18″ vertical adjustment and quick return.

Complete description on request.

ROCKFORD MILLING MACHINE CO., Rockford, Illinois

FOREIGN REPRESENTATIVES: Great Britain, A. A. Jones & Shipman, Ltd., Leicester, England. France and Belgium, Louis Besse, Paris, France. Italy and Colonies, Societa Anonima, Adler & Co., Milan, Italy. Scandinavia, Rylander & Asplund, Stockholm, Sweden. Spain and Portugal. Casamitjana Hermanos, Barcelona, Spain. Australia, Selson Engineering Co., Melbourne, Australia. Russia, M. Mett Engineering Co., Petrograd, Russia.

Where do you get your Cams—Make them or buy them?



You can get Rowbottom Cams either way. A Rowbottom Cam Milling Machine installed in your plant is one of the most satisfactory, least expensive ways to produce them in quantity. If your needs do not justify the installation of a special machine, get in touch with our contract department. You will find us able to give good deliveries on accurate cams of all classes at fair prices.

Either way we guarantee your satisfaction with Rowbottom Machines and Service. Try them.

THE ROWBOTTOM MACHINE CO.

Factory, Waterville, Conn.

WATERBURY CONNECTICUT

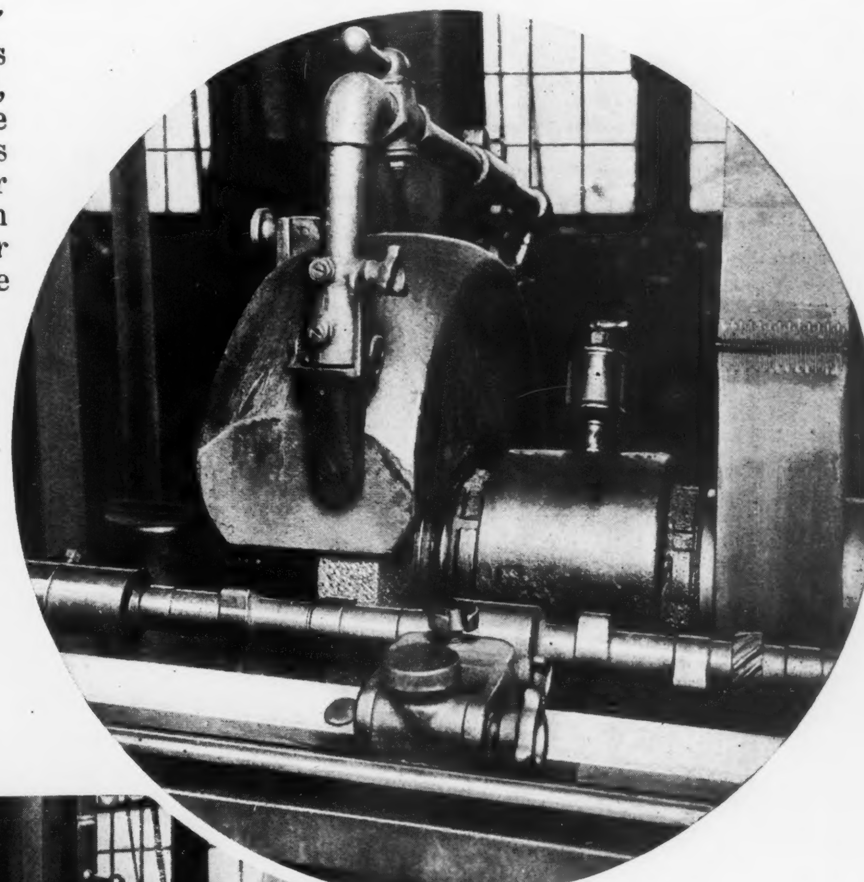
Rowbottom for Cams

Waltham Grinding Wheels

Better the Time Allowance by more than a Minute on this Work

Waltham 36-R Alowalt Grinding Wheels, size 18″ x 2″ x 5″ have been used for more than two years for *rough* grinding cams on forged nickel steel camshafts at the Plainfield, N. J., plant of the International Motor Company.

Each shaft has 8 cams ¾″ wide, about 1/16″ of stock is removed on each cam and, though the estimated time for the entire operation was 19.8 minutes, the operator has managed to hold it down to 18 minutes floor to floor since Waltham Wheels have been in use.



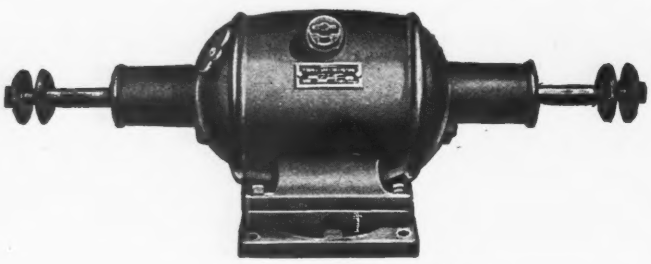
ALOWALT

CARBOWALT

Waltham Wheels are standard for cam roughing just as they are for countless other difficult grinding jobs. Our production data on your problem should be interesting to you. Our Sales Service should be very valuable. Let our experts help you.

WALTHAM GRINDING WHEEL COMPANY

Waltham, Mass., U. S. A.



Medium Duty Buffer
Bench Type

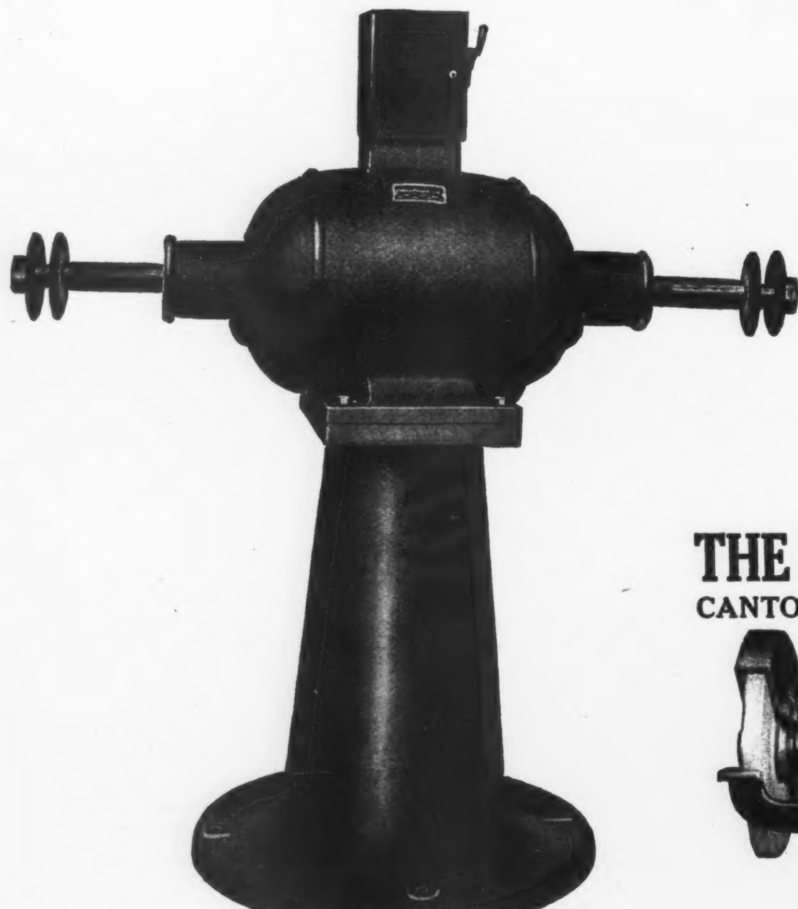
Medium Duty Grinder

DILLON

ELECTRIC GRINDERS *and* BUFFERS

Self Contained, Ball Bearing, Dust Proof, Noiseless

Made for Either Direct or Alternating Current



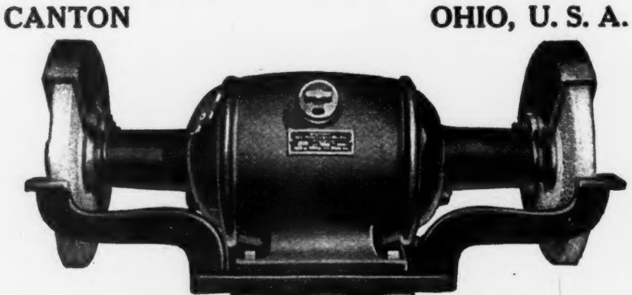
Heavy Duty Buffer

Simple in design—no excess parts. Medium Duty Machines made in ½, 1 and 2 H. P. capacities.

Heavy Duty Machines made in 3, 5 and 7½ H. P. capacities.

Write for descriptive Booklets

THE DILLON ELECTRIC CO.
CANTON OHIO, U. S. A.



Medium Duty Grinder
Bench Type

"ABRASIVE"

Borolon TRADE MARK — TRADE ABRASIVE MARK REGISTERED — **Electrolon** TRADE MARK

GRINDING WHEELS

Specify Borolon when wheels are required for grinding materials of high tensile strength such as steel, annealed malleable iron, etc. Electrolon is best suited for low tensile materials such as cast iron, unannealed malleable iron, brass, bronze, aluminum, etc. Both Borolon and Electrolon Grinding Wheels are manufactured by the following processes:

VITRIFIED SILICATE ELASTIC RUBBER

Use Borolon Grain For Your Polishing Requirements

ABRASIVE COMPANY

BRIDESBURG, PHILADELPHIA, PA., U. S. A.

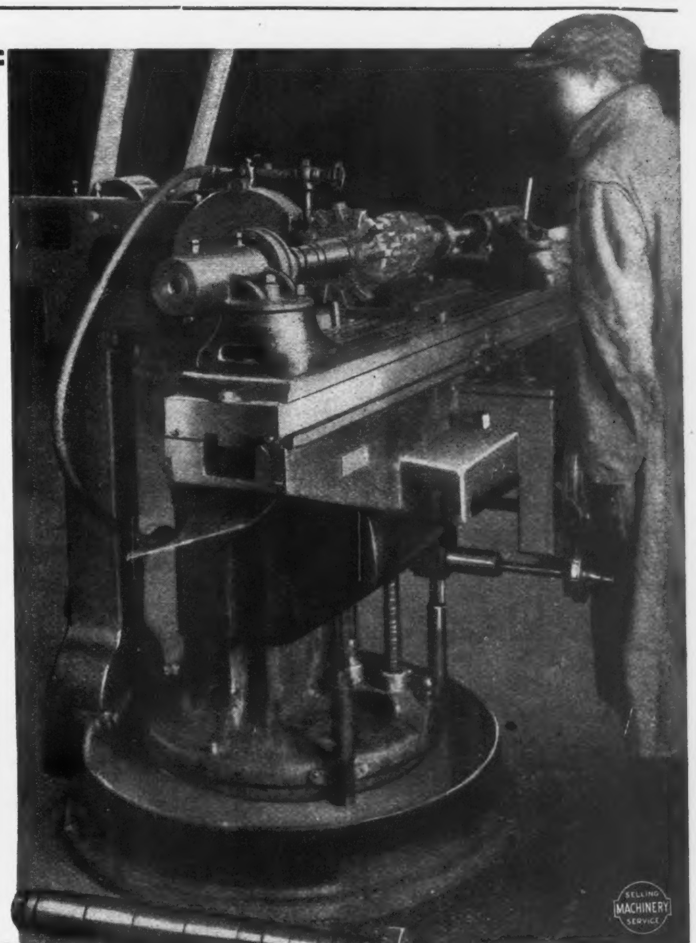
Chicago Branch: 566 West Washington Boulevard

Fully Equipped!

Thompson Universal Grinding Machines provide for emergencies. Easily changed for handling internal, external or surface grinding operations in turn, they are ideal tool-room grinders. Accurate construction and many operating conveniences make them equally profitable as straight manufacturing equipment.

The cut shows a cutter grinding operation in the tool-room of a large machine tool building plant.

Bulletin 13 Gives the Details.

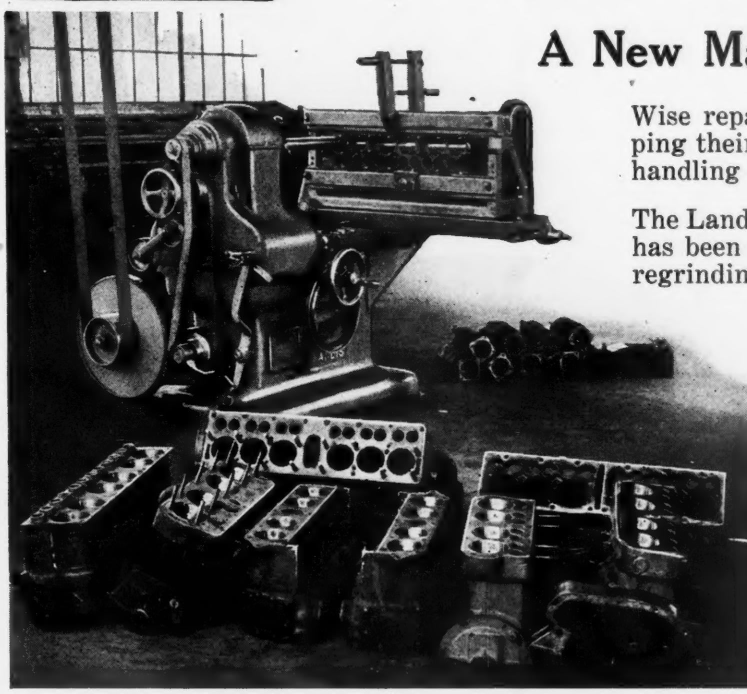


The Thompson Grinder Co.

SPRINGFIELD, OHIO, U. S. A.

DOMESTIC. Motch & Merryweather Mchy. Co., Cleveland, Ohio. Manning, Maxwell & Moore, Inc., New York, Philadelphia, Pittsburgh, Buffalo, Cincinnati, St. Louis, Seattle. Hill, Clarke & Co., Boston, Mass. Kemp Machinery Co., Baltimore, Md. Riverside Machinery Depot, Detroit, Mich. Coghlin-Kirkby Machinery & Supply Co., Toledo, Ohio. Wayne Machinery Co., Fort Wayne, Ind., Dayton, Ohio. Hill, Clarke & Co., Chicago, Ill. F. E. Satterlee Co., Minneapolis, Minn. F. O. Stallman Supply Co., San Francisco, Los Angeles, Cal. FOREIGN: Bevan & Edward Pty., Ltd., Melbourne, Sydney. Selson Engineering Co., London, Belgium, France, Italy.

LANDIS No. 5 Cylinder Grinding Machine



A New Machine for your Shop

Wise repairmen and garage men are equipping their shops with the very best tools for handling the on-rush of repair work.

The Landis No. 5 Cylinder Grinding Machine has been recently put on the market for the regrinding of cylinders, single or en bloc.

It is backed by the Landis reputation for simplicity of design and manipulation and garages in which this machine has been installed, report exceptionally high production.

Write for further information; let us also send you circulars on our No. 4-A Special machine for regrinding crankshafts.

LANDIS TOOL COMPANY, Waynesboro, Pa.

NEW YORK OFFICE: 51 CHAMBERS STREET

GRAND RAPIDS

Drill Grinders
Tap Grinders
Universal Grinders

The Grand Rapids Line covers practically all Drill, Tap and Universal Grinding requirements. Easily operated, accurate and economical, Grand Rapids Grinders are designed with the view of maximum accomplishment, and are standard equipment in many representative plants.

Write for the catalog

GRAND RAPIDS GRINDING MACHINE COMPANY
29 OTTAWA AVENUE
GRAND RAPIDS MICH., U. S. A.

Gardner Disc Grinders

There's nothing like "Gardnergrinding" for your flat surface work

GARDNER MACHINE COMPANY
414 Gardner St., Beloit, Wis., U. S. A.

DIVINE BROS. CO.

UTICA N. Y., U. S. A.

POLISHING AND FINISHING ENGINEERS

Avail yourself of our Expert Service and bring your methods up-to-date

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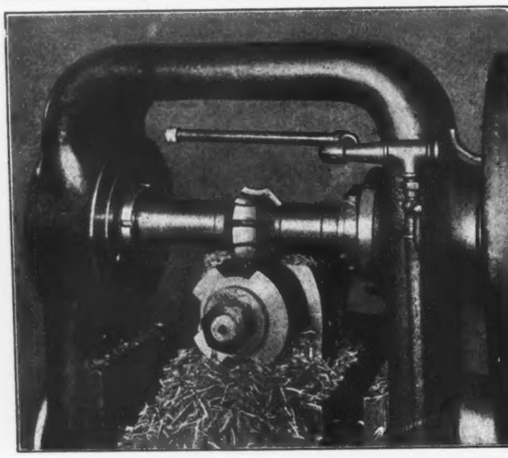
BENCH MILLING MACHINE

For Small Work in Large Quantities

This machine is built with the same care as our larger millers; it is accurate and right in every particular; highly profitable on a wide variety of small work. Can be had with floor column if desired. Ask for complete description.

THE CARTER & HAKES COMPANY
Sterling Place WINSTED, CONN.



Briggs Millers for Speed and Power

The work shown is a special punch, 4¾" O.D., in which four slots are milled—each 2" wide and ½" deep. Time to complete the four, including indexing, was exactly 10 minutes. A typical example of Briggs Milling. Details?

Gooley & Edlund, Inc., Cortland, N.Y., U.S.A.

OVER-SEAS REPRESENTATIVE

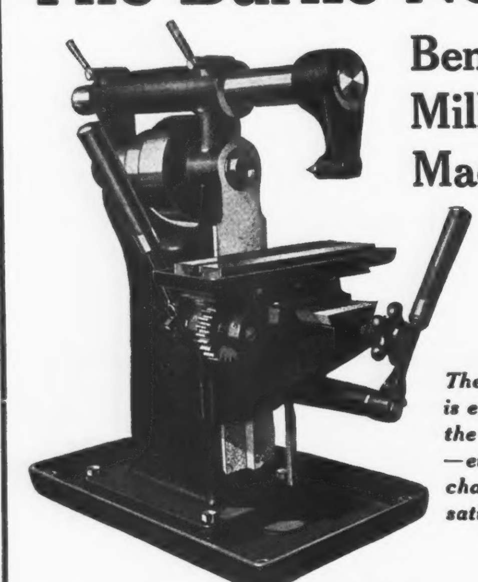
ALMACOA ALLIED MACHINERY COMPANY OF AMERICA ALMACOA
51 CHAMBERS ST. NEW YORK, U.S.A.

Paris, Turin, Zurich, Barcelona, Petrograd

DOMESTIC AGENTS: Vandyck-Churchill Co., New York and New Haven; Monarch Machinery Co., Philadelphia, Pa.; Lynd-Farquhar Co., Boston, Mass.; Syracuse Supply Co., Syracuse, Rochester, and Buffalo, N. Y.; Brown & Zortman Machinery Co., Pittsburgh, Pa.; English & Miller Machinery Co., Detroit, Mich.; Federal Machinery Sales Co., Chicago, Ill.; Vonnegut Machinery Co., Indianapolis, Ind.; Cleveland Tool & Supply Co., Cleveland, O.; Blackman-Hill-McKee Machinery Co., St. Louis, Mo. FOREIGN AGENTS: Burton, Griffiths & Co., Ltd., London, Manchester and Glasgow; Andrews & George, Tokyo.

The Burke No. 3

Bench Milling Machine



Price $155

The Machine is efficient, the price fair—every purchaser is a satisfied user.

Vertical Milling Attachment, Slotting Attachment, Index Centers, Stationary or Tilting Head, and other special features give capacity for a wide range of fine milling work.

Catalog shows other sizes of Milling Machines, also Tapping Machines, Drill Presses and Cold Saws.

Get the details and prices.

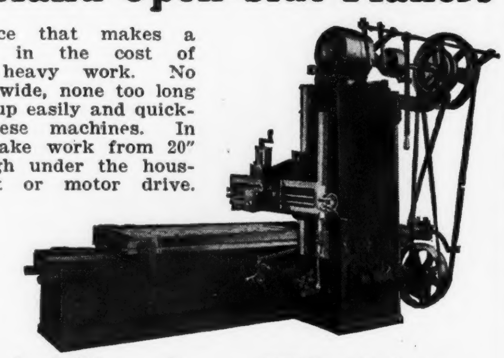
The Burke Machine Tool Co.

516 Sandusky St. Conneaut, Ohio

Dealers in foreign countries, write for addresses.

Cleveland Open-Side Planers

Convenience that makes a difference in the cost of handling heavy work. No work too wide, none too long to be set up easily and quickly on these machines. In sizes to take work from 20" to 72" high under the housing. Belt or motor drive.



Circular

Established 1900

The Cleveland Planer Co. 3152 Superior Avenue CLEVELAND, OHIO, U. S. A.

Elgin Milling Attachment

Put One on Your Bench Lathe

It will greatly increase its range. Here it is milling angle cutters. Has interchangeable spindles which may be used in either upper or lower bearings. Graduated swivel head adjustable to any angle. Just what you want for milling taper reamers, bevel gears, gages and small precision work.

Write for particulars

ELGIN TOOL WORKS, Inc.
ELGIN ILLINOIS

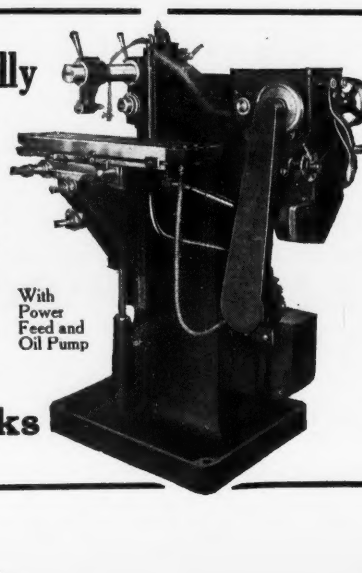
For Milling Small Parts Economically

With Hand and Weight Feed

The "Standard" line of hand and weight feed milling machines has been developed to handle a wide variety of small pieces which do not require the services of a large machine.

At the left is shown the medium sized plain machine, which provides a working surface 7½" by 25", with 17" longitudinal crank feed, 6" hand lever feed and 6" cross feed. Table has 15" vertical adjustment, spindle 4½" and spindle speeds range from 96 to 547 R.P.M.

The machine at the right is provided with both hand and motor drive—a recently designed model which we'll be glad to describe on request.



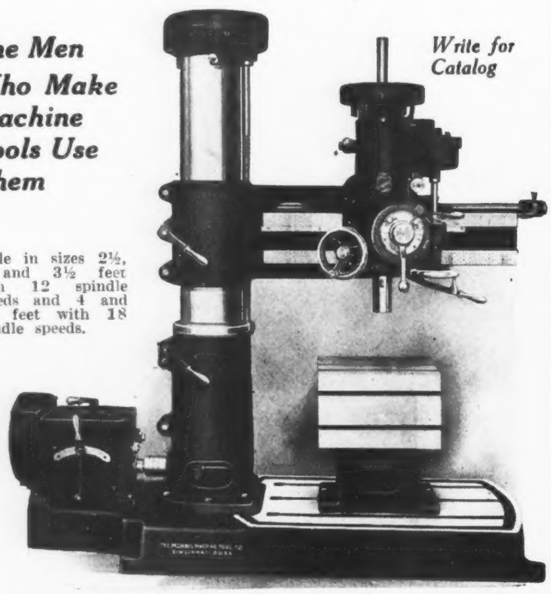
With Power Feed and Oil Pump

Standard Engineering Works
Pawtucket, Rhode Island

MORRIS RADIALS

The Men Who Make Machine Tools Use Them

Write for Catalog



Made in sizes 2½, 3 and 3½ feet with 12 spindle speeds and 4 and 4½ feet with 18 spindle speeds.

After all the most critical judges of machine tools are those who build them. This may be why Morris Radials are so frequently chosen for this super-important work.

The Morris Machine Tool Company
CINCINNATI OHIO, U. S. A.

Represented by The Niles-Bement-Pond Company
111 Broadway, New York, N. Y.

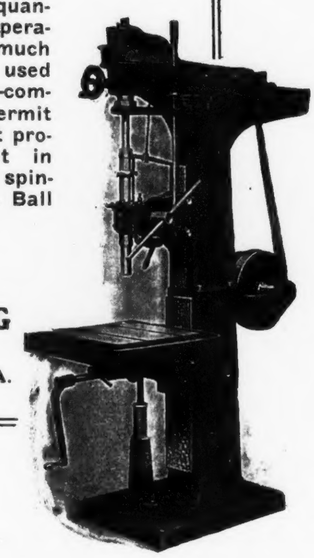
How About This?

Avey

No. 3 Heavy Duty Ball Bearing Driller

How about this machine? Isn't it just what you've been looking for to improve the quality and increase the quantity of your drilling operations? Its high speeds—much higher than ordinarily used for ¾" to 1⅛" holes—combined with fine feeds permit of a possible 50 per cent production increase. Built in combinations up to six spindles, hand or power feed. Ball bearings throughout.

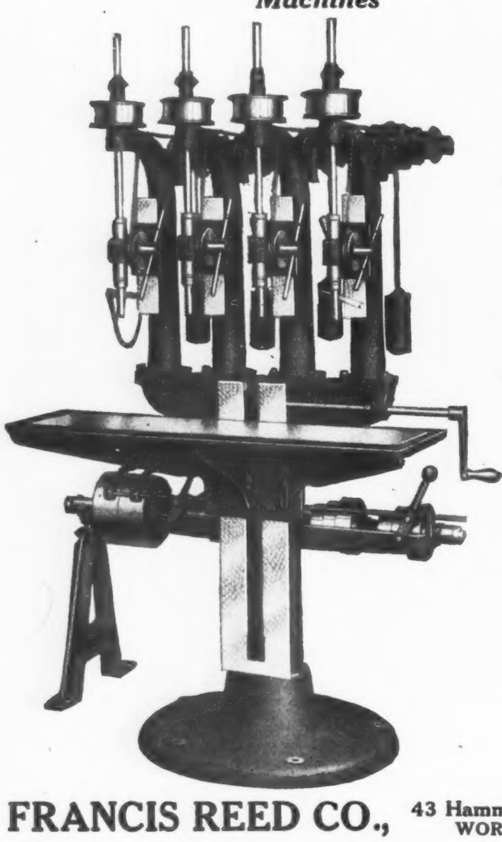
Write for Bulletin



THE AVEY DRILLING MACHINE CO.
CINCINNATI, OHIO, U. S. A.

QUALITY TOOLS

Plain and Ball Bearing — Sensitive Drilling Machines



1—7 Spindles ½" Capacity

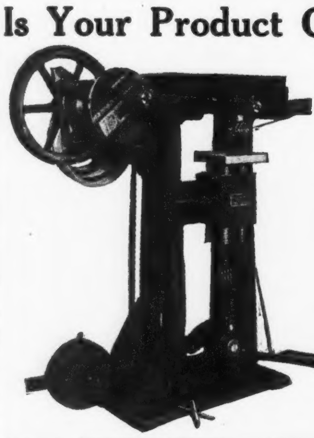
1—6 Spindles ¾" Capacity

1—4 Spindles ½" Capacity Bench.

Power Feeds

FRANCIS REED CO., 43 Hammond Street, WORCESTER, MASS.

Is Your Product Ordered By Name?



Now-a-days most people order by brand. To get repeat orders mark your goods clearly with

Dwight-Slate Marking Machines

Let us handle also your steel lettering and die engraving. Write for literature and get the details and list of users of our machines and dies.

NOBLE & WESTBROOK MFG. COMPANY
19 Asylum St. Hartford, Conn

Cleveland Horizontal Boring, Milling and Drilling Machines

Convenient, Accurate—for precision work

Get the circular now.

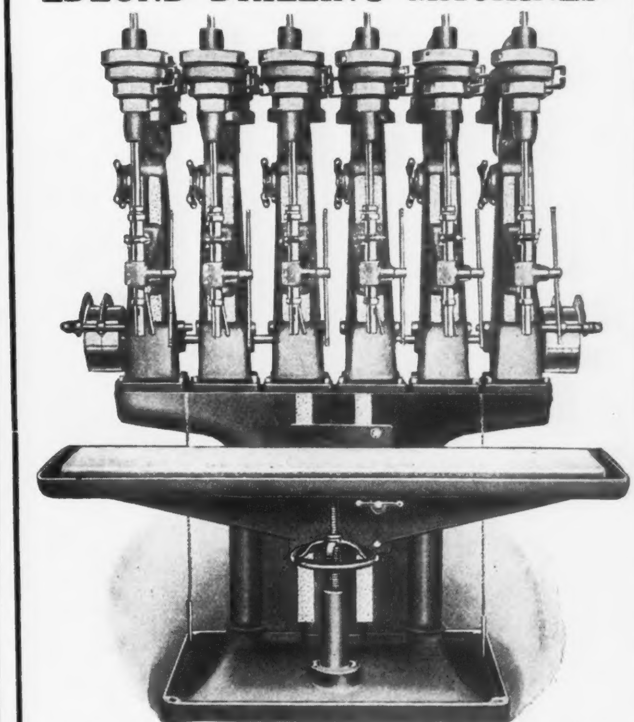
The Cleveland Machine Tool Co.
3221 Superior Ave. *Established 1907* **Cleveland, Ohio**

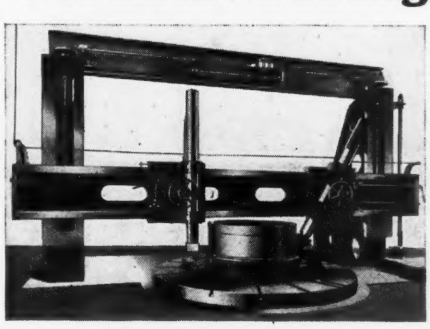
Universal (Horizontal) Boring Machine

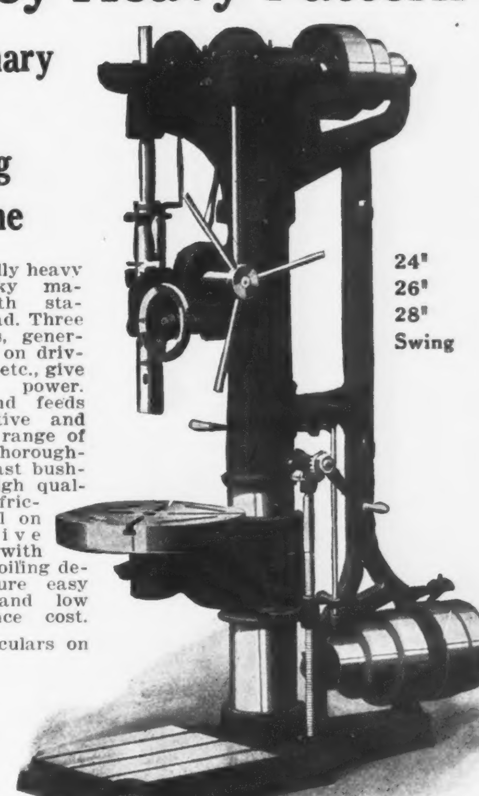
"Where accuracy counts, we win"

Designed for
DRILLING, MILLING, BORING, FACING

Universal Boring Machine Company
HUDSON, MASS., U. S. A.

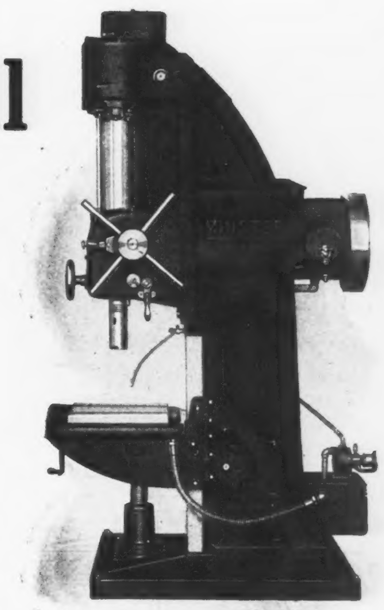






You can Go the Limit with a

Minster Hi-Duty Drill



Big carefully balanced machines with plenty of power to easily handle the toughest job within their capacity. Versatility that gives unusually wide range for machines of this size, operating conveniences that simplify production difficulties make Minster Drills leaders in many big shops where the economy of modern methods and equipment is recognized.

Made in three sizes 2″, $2\frac{1}{2}$″, $3\frac{1}{4}$″; all sizes have 12 changes of speed and feed, high carbon steel spindle, flood lubrication and ball bearing construction.

Remember "Minster Drilling is Limit Drilling" and look over these big machines.

THE MINSTER MACHINE COMPANY, Minster, Ohio

LIST OF AGENTS:

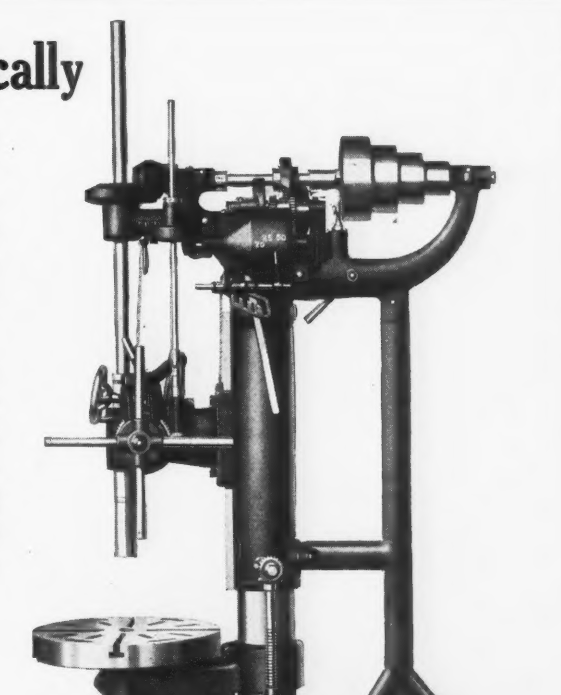
DOMESTIC: Vandyck-Churchill Co., Singer Bldg., New York, N. Y., Philadelphia, Pa.; J. S. Miller Machinery Co., Pittsburgh, Pa.; Saxer Machinery Co., Erie, Pa.; Cleveland Tool & Supply Co., Cleveland, Ohio; E. A. Kinsey Co., Cincinnati, Ohio, Indianapolis, Ind., Columbus, Ohio; W. J. Baird Machinery Co., Detroit, Mich.; McMullen Machinery Co., Grand Rapids. Mich.; Federal Machinery Sales Co., Chicago, Ill., Milwaukee, Wis.; Colcord-Wright Machinery & Supply Co., St. Louis, Mo.; Herberts Machinery & Supply Co., San Francisco, Cal., Los Angeles, Cal.; Wilcken-Schenck Co., Seattle, Wash.; Zimmerman-Wells-Brown Co., Portland, Oregon; Savage & Winter Co., St. Paul, Minn.; The Walraven Co., Atlanta, Ga.; Manufacturers Selling Agency, Birmingham, Ala.; Oliver H. Van Horn Co., Inc., New Orleans, La.; Archenhold Automobile Supply Co., Waco, Texas. FOREIGN: Henri Benedictus, Brussels, Belgium; Coats Machine Tool Co., London, England; Pedro Merlini, Buenos Aires, Argentina; Quinones Hardware Corp.. Havana, Cuba; R. S. Stokvis & Zonen, Inc., Paris, France. CANADIAN: Williams & Wilson, Ltd., Montreal, Quebec; A. R. Williams Machinery Co., Ltd., Toronto, Ont.

The 26" Rockford Drills Economically

It belongs to a line of machines noted for strength, rigidity and power; buyers looking for equipment capable of standing severe service and of handling a wide variety of work rapidly and accurately find the Rockford 26″ Sliding Head Drilling Machine a profitable investment.

It is accurately balanced, easy to operate, greatest distance, spindle to base, 51″, spindle to table, 37″. Table travel on column 20″, spindle travel 11″, sliding head travel, $20\frac{3}{4}$″. There is a large quantity of drilling and tapping within the range of this machine. It will pay you to investigate its advantages.

Let us send you booklet with full description.



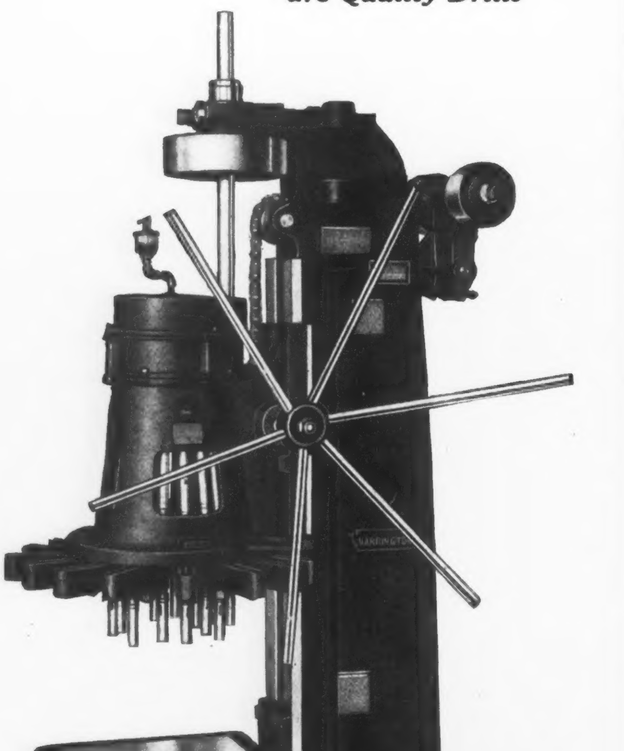
THE
ROCKFORD
DRILLING MACHINE Co
·ROCKFORD·
ILL., U.S.A.

Harrington Multiple Spindle Drills

Quality drilling equipment insures a higher grade of work, with less interruption and delay, and consequently less expense of operating.

Edwin Harrington Son & Co., Inc.
Philadelphia, Pa.

Harrington Drills are Quality Drills



Silver Upright Drilling Machines

Two sizes—20" and 25"—arranged singly or in gangs. The cut shows the Silver 20" drill with the changes recently incorporated in its design to increase its capacity and general efficiency.

Circular gives comparative tables of old and new machines.

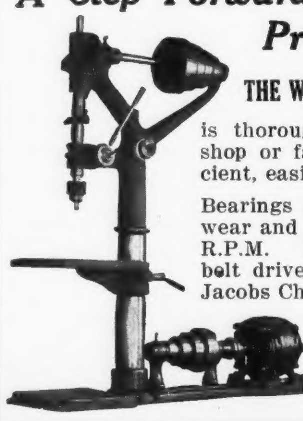
Send for it.

The Silver Manufacturing Co.

385 Broadway SALEM, OHIO

LONDON PARIS BRUSSELS
NEW YORK GENOA SYDNEY CAPE TOWN

A Step Forward in the Field of Production Drilling



THE WINTERHOFF 10½" BENCH DRILL

is thoroughly satisfactory for either shop or factory. It is sensitive, efficient, easily operated and durable.

Bearings are ball thrust adjusted for wear and end play. Runs up to 2,400 R.P.M. Made with either motor or belt drive. Regularly equipped with Jacobs Chucks.

0" to ½" capacity. Write for details.

WINTERHOFF TOOL & MACHINE CO.
ELKHART INDIANA

"HOLE HOG" DRILLS REAMS BORES HOLES IN LINE

MOLINE TOOL COMPANY, Moline, Ill.

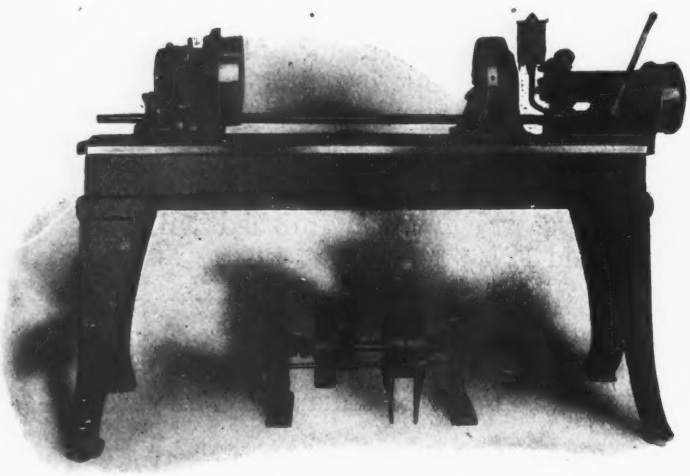
THE WESTERN

***(low hung drive)* Radial Drill**

Driven by a set of gears at the **lower** end of the spindle, close to the work.
This feature practically eliminates all torsional strain and vibration. It permits deeper, heavier cuts to be made faster and better.

Literature on request
WESTERN MACHINE TOOL WORKS
Holland, Mich., U. S. A.

THE WHITON
Revolving Centering Machine



For Accurately Centering Finished Shafts

The cut shows new *Revolving Centering Machine*—a large size of the well-known machine of this type. It is heavier throughout and has capacity to center shafts up to 5 inches in diameter.

Constructed same as the smaller machines and embodies all the special features.

Circulars and prices sent upon application.

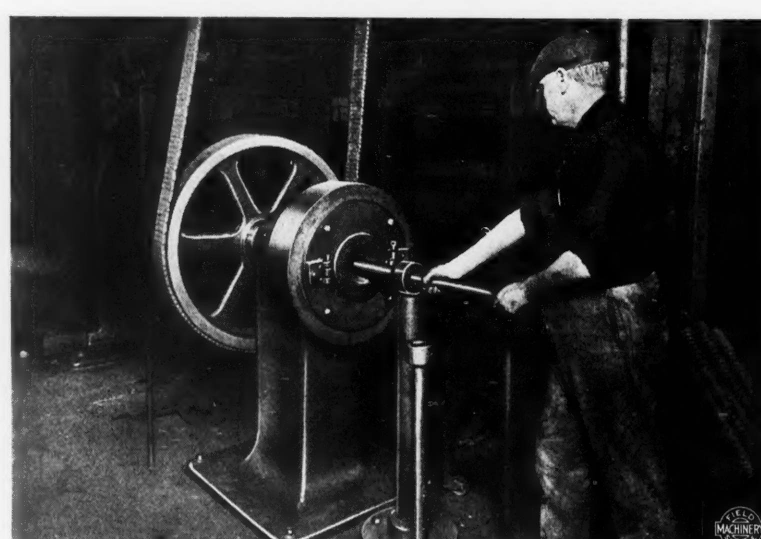
THE D. E. WHITON MACHINE COMPANY
NEW LONDON, CONNECTICUT, U. S. A.

DAYTON SWAGING

Reducing Pipe Ends to Uniform Size

"The Best Way Twenty Years Ago—The Best Way Now"

A manufacturing process that has survived in an up-to-date metal working shop for twenty years is worth notice in these days of ever changing methods and production standards. The three Dayton Swaging Machines at the Ingersoll-Rand Company, Phillipsburg, N. J., installed 18 to 20 years ago, have given uninterrupted service during all these years. The job shown is typical—reducing the ends of wrought iron pipe from 1⅝" outside diameter to fit holes 1.625 in diameter—snug fit required. They found out here about a generation ago that "Dayton Swaging Pays"—and they've been reaping the profits of their foresight ever since.



The principle is right, the method can scarcely be improved on, the machines are built to last. Ask for details.

THE TORRINGTON CO., Excelsior Plant, 57 Field Street, Torrington, Conn.
SUCCESSORS TO EXCELSIOR NEEDLE COMPANY

Coventry Swaging Co., Ltd., White Friars Lane, Coventry, England, Agents for Great Britain. Fenwick Freres & Co., 8 Rue de Rocroy, Paris, France, Agents for France, Italy, Belgium, Spain, Portugal and Switzerland.

ATKINS

METAL CUTTING SAWS

ECONOMY

The cutting of one metal by another is not a difficult process with

Atkins Metal Cutting Saws

They are made to withstand the constant wear and tear of heavy duty. They possess to the highest degree both toughness and ductility, which minimize breakage of the teeth and even the blades themselves.

By using Atkins quality saws in your various cutting operations you can get maximum results with minimum expense, thus saving money.

Ask for literature on any of the following: *Atkins AAA Non-Breakable Hack Saw Blades and Frames, Circular Metal and Slitting Saws, Hot Saws, Cold Saws, Kwik-Kut Hack Saw Machines and Blades and Metal Band Saw Machines.*

"A Better Saw for Every Use"

E.C. ATKINS & CO.

ESTABLISHED 1857 THE SILVER STEEL SAW PEOPLE

Home Office and Factory, INDIANAPOLIS, INDIANA

Canadian Factory, Hamilton Ontario

Machine Knife Factory, Lancaster N.Y.

Branches Carrying Complete Stocks In The Following Cities:

Atlanta	New Orleans	Seattle
Memphis	New York City	Paris, France
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Minneapolis	San Francisco	Vancouver, B.C.

Something for Nothing

Cone Pulley Drive with Countershaft

HARDENED AND GROUND JOURNALS
RING OILING BUSHINGS

THERE IS less friction on a HARDENED JOURNAL: especially, when lubrication is ample and constant; if there is less friction, there is much less wear. YOU would not buy an automobile with soft journals—squirt can lubricated; WE conserve power and guarantee on heavy duty, 25% or more reduction with the same input power.

BUT, the QUEEN CITY is not a one feature shaper: it has EVERY ESSENTIAL for the FAST PRODUCTION of GOOD WORK, viz; ALL HELICAL DRIVING GEARS, SEMI-STEEL CASTINGS, HYATT ROLLER BEARINGS in C/S, SELF-ADJUSTING, SELF-ALIGNING TABLE SUPPORT, and QUEEN CITY QUICK CHANGE FEED. (Patent applied for.)

CRANK BLOCK and CRANK PIN ARE HARDENED and GROUND. BULL GEAR JOURNAL IS GROUND and ALL THESE have constant lubrication, immediately machine is started, assuring quiet, easy running and precluding stuck journals.

ALL flat-wearing surfaces are of extreme area. Note simplicity of design.

Furnished with Single Pulley (Gear Box) and Constant or Adjustable Speed Motor Drives; Single Screw Vise optional; sizes cover every requirement for Tool-room and Die Makers up to the heaviest for Railroad and Forge Shops. Send for the dope.

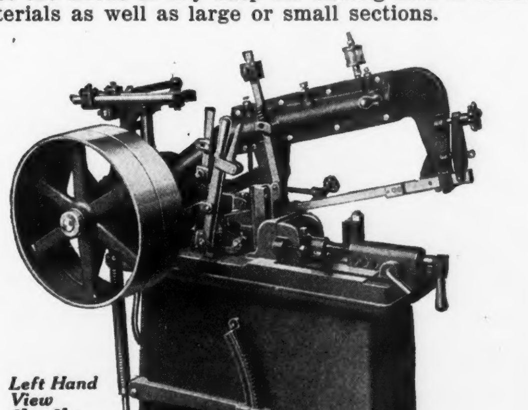
Queen City Machine Tool Co., (Station V) **Cincinnati, Ohio**

FOREIGN AGENTS: Alfred Herbert, Ltd., for Great Britain, France, Belgium, Spain and India.

Also Queen City Plain Cylindrical Grinding Machines

Peerless HIGH SPEED
HACK SAW MACHINES

Meet the needs of any shop for sawing soft or hard materials as well as large or small sections.



Left Hand View 6" x 6"— Belt Drive

The saw frame and guide on all Peerless High Speed machines is overbalanced. Feed pressures from 6 pounds to 170 pounds by 6 pound steps may be applied to the blade by raising lever shown on left side of the machine. Sizes 6" x 6", 9" x 9", 13" x 16". Motor mountings or six-speed boxes may be applied to all machines.

PEERLESS MACHINE. COMPANY

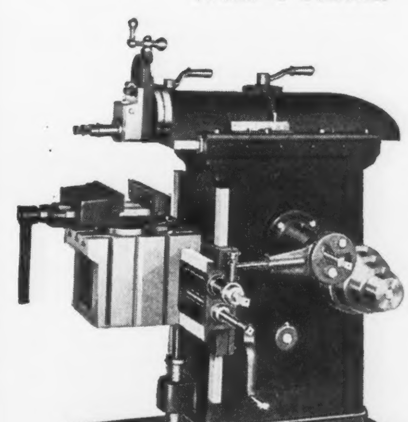
1611 Racine Street **RACINE, WISCONSIN**

"It's a Mighty Fine Little Machine"

Said a prominent manufacturer, referring to the new 12" Whipp Shaper; "and the extremely low price you are asking should tempt many concerns to install it."

The New 12" Single Geared
WHIPP SHAPER

(WITH 14" STROKE)



Whipp Shapers come in sizes 12-14-16 single geared; 16-20 back geared. Ask about our 26" Combined Open-side Crank Planer and Shaper. Prices and particulars on request.

THE WHIPP MACHINE TOOL CO.

SIDNEY **OHIO, U.S.A.**

Shapers

and

Gear Cutting Machines

G&E EBERHARDTS

Single Pulley Shaper Drive, part of the machine, not an attachment.

Speed Gear Box with all heat-treated steel gears.

The right speed for every stroke.

"More strokes per minute"

GOULD & EBERHARDT

"HIGH DUTY" SHAPERS

AUTOMATIC GEAR AND RACK CUTTING MACHINERY

ESTABLISHED 1833 NEWARK, N.J. U.S.A. CHANCELLOR AVE.

DOMESTIC AGENTS

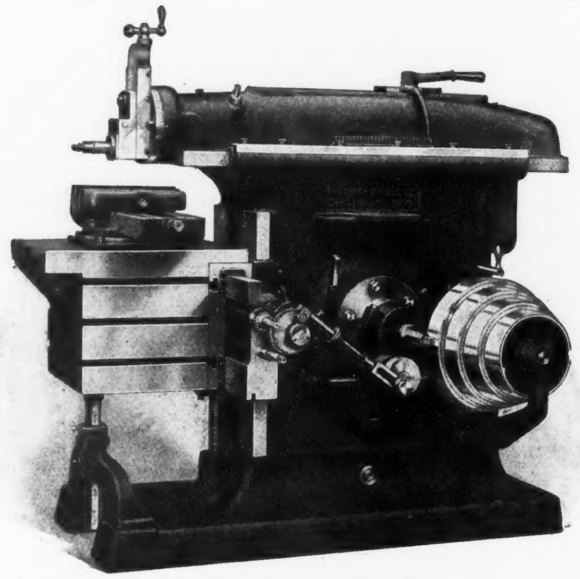
Motch & Merryweather Machinery Co.: Cleveland, Pittsburgh, Detroit and Cincinnati. Henry Prentiss & Co.: New York, Boston, Buffalo, Syracuse, Rochester, Hartford, Conn. Marshall & Huschart Machinery Co.: Chicago, Ill. Marshall & Huschart Machinery Co. of Indiana: Indianapolis, Ind. Dewstoe Machine Tool Co.: Birmingham, Ala. Eccles & Smith Co., Los Angeles, San Francisco and Portland, Ore. Elliott & Stephens Machinery Co.: St. Louis, Mo. Hallidie Machinery Co.: Seattle, Wash. Kemp Machinery Co.: Baltimore, Md. Powell Supply Co.: Omaha, Nebr. Robinson, Cary & Sands Co.: St. Paul, Duluth, Minn. Salt Lake Hardware Co.: Salt Lake City, Utah. Seeger Machine Tool Co.: Atlanta, Ga. W. E. Shipley Machinery Co.: Philadelphia, Pa. Oliver H. Van Horn Co., Inc.: New Orleans, La.

CANADIAN AGENTS

F. F. Barber Machinery Co.: Toronto, Ontario. A. R. Williams Machinery Co.: St. John, N. B., Winnipeg, Manitoba, Montreal, Quebec, Halifax, N. S.

WE CONFINE OURSELVES TO BUILDING

Shapers Exclusively



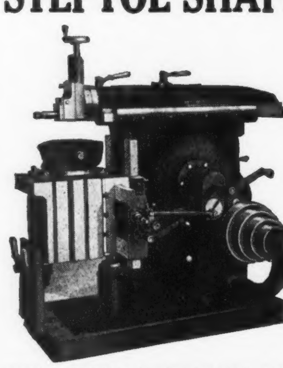
Crank Sizes: 12", 14", 16", 20", and 25"—Either Cone Driven or through Speed Box, 28" and 28/32" B.G. All Geared Single Pulley Drive

The Smith & Mills Company

CINCINNATI OHIO, U. S. A.

FOREIGN AGENTS: G. & F. Limbourg Freres, Brussels, Belgium; Burton, Griffiths & Co., Ltd., London, England; Van Rietschoten & Houwens, Rotterdam, Holland; Reid Brothers (Johannesburg) Ltd., Johannesburg, South Africa; J. Lambercier & Co., Geneva, Switzerland; Zurich, Switzerland; V. Lowener, Copenhagen, Denmark; Christiania, Norway; Stockholm, Sweden; H. P. Gregory & Co., Sydney, N. S. W.; Rene Berndes Co., Havana, Cuba; Horne Company, Ltd., Tokyo, Japan; Daniele Stussi, Milan, Italy.

STEPTOE SHAPERS and MILLERS



Should be your first consideration in equipping your machine shop.

Seventy-six years of experience in the manufacture of high-grade tools is a recommendation that you should not overlook.

Send for a copy of our catalogue showing the entire line of STEPTOE shapers and milling machines.

THE JOHN STEPTOE COMPANY 2951-61 Colerain Ave. CINCINNATI, OHIO

Broaching Machines and Broaches

Our **years** of **experience** in the successful manufacture of broaching equipment assures you of the most **up-to-date** and **progressive** methods.

May we not quote? Write for catalog

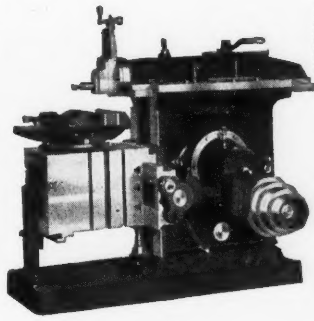
J. N. LAPOINTE CO. of New London, Conn.

"OHIO" PLANERS SHAPERS

Leaders Since 1887

Address Below or Local Dealer

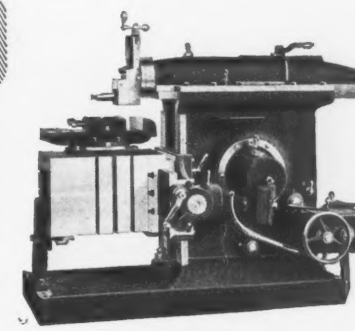
OHIO MACHINE TOOL CO., Kenton, Ohio



Columbia Shapers

The quick-change feed is a typical time-saving feature. Automatically adjusts itself to position of rail. One handle instantly controls the amount, another the direction of the feed. Bevel gear reverse insures feed taking place on return stroke. Feed gears are steel, hardened and running in oil, fully enclosed.

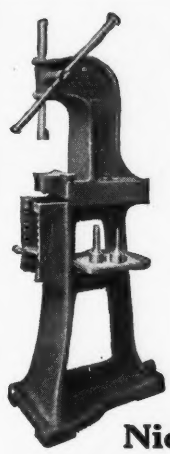
This and other details fully described in Bulletin No. 7. Send for it today.



Cone Drive
16, 20, 24, 28, 32 Inch

The Columbia Machine Tool Company
Hamilton, Ohio

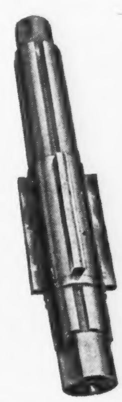
Speed Box, Friction Clutch and Brake and Single Pulley Drive



The Nicholson Arbor Press Encourages Better Work

Your workmen will appreciate its ability to save time and labor. Besides pressing out arbors, it's a big help in broaching, punching, bending and similar work. The No. 3 size is capable of instantly exerting a three-ton pressure.

Nicholson Expanding Mandrels



A set of nine of these will replace all your solid mandrels. They save the time lost in calipering solid mandrels or turning them down to size, for they fit any hole, round or square from ½" to 7". And they take up very little space.

Let us send you press or mandrels or both on 30 days' trial, to prove their value to you. Write for free booklets describing these and other Nicholson specialties.

W. H. Nicholson & Co.
112 Oregon St., Wilkes-Barre, Pa.

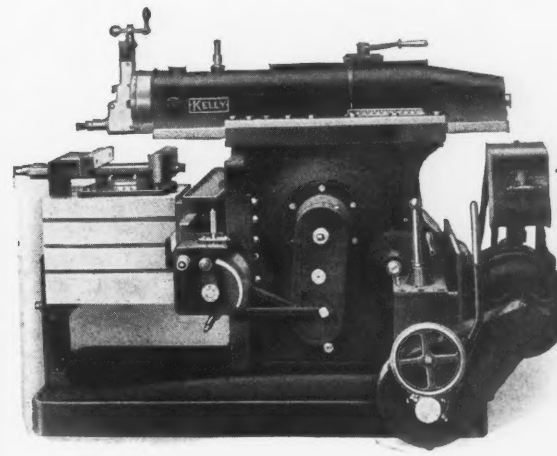
AGENCIES:

Burton, Griffith & Co., Ltd., Ludgate Square, London, E. C.
Burton Fils, 68 Rue des Marais Paris, France
Monti & Oscuro Milan, Italy
Andrews-George Co. 16 Takegawa-cho, Kiobashi-ku Tokyo, Japan.

Kelly Crank Shapers

Heavy machines rigid enough to insure their accuracy on the heaviest work within their wide capacity, with operating conveniences that enable them to handle it satisfactorily.

The tilting table, swivel vise, motor drive and other characteristically modern features are fully described in our circular. Send for it.



THE R. A. KELLY COMPANY
XENIA, OHIO, U. S. A.

Pedrick Crank Pin Turning Machine

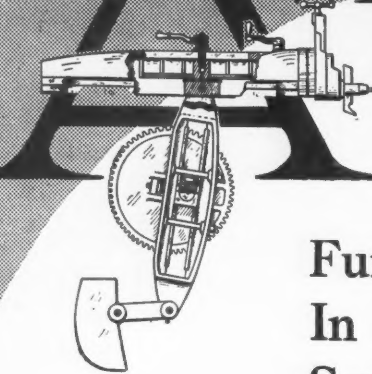
This handy portable tool is for truing crank pins of stationary engines or locomotives in position.

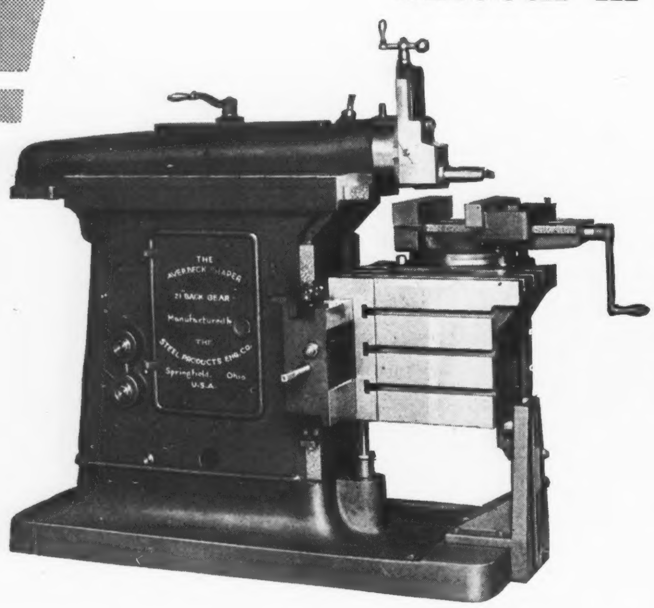
It is a time saver and as accurate as a lathe. Several sizes to meet all dimensions.

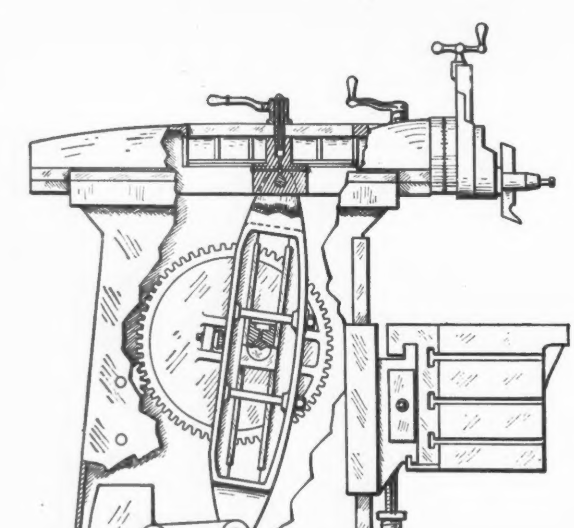
Write for details.

Pedrick Tool & Machine Company
3639 N. Lawrence St. PHILADELPHIA

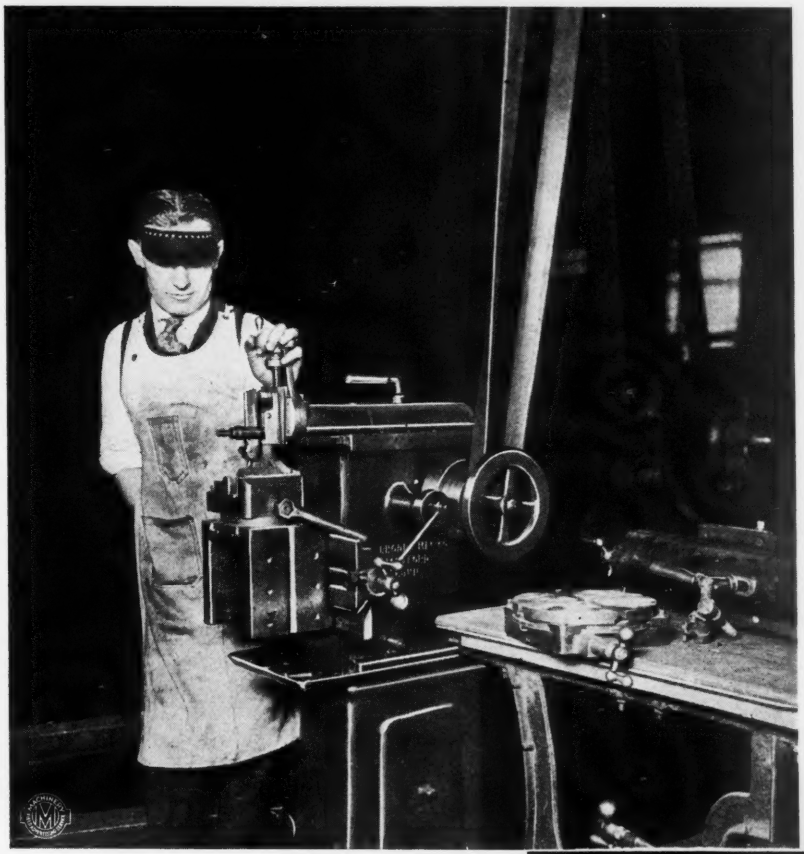
Manufacturers of Portable boring, milling and pipe bending machinery and floor boring machines.




THE
AVERBECK SHAPER
21 BACK GEAR
Manufactured by
THE
STEEL PRODUCTS ENG. CO.
Springfield, Ohio
U.S.A.



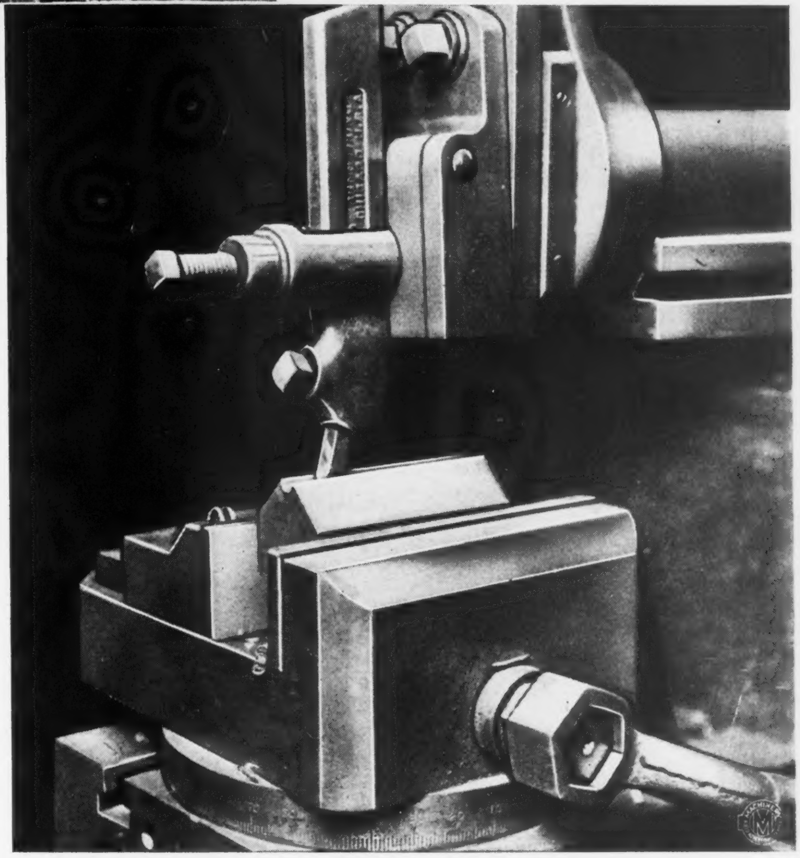
Rhodes Slotter and Shaper



"Just the Machine for us" says this Company

For concerns which make a specialty of difficult die work—where complicated contours and close limits are the rule—the Rhodes Combination Slotter and Shaper is a real asset.

The Metalform Tool & Stamping Company of Philadelphia, for instance, tells us that for making tools and dies the Rhodes can't be beaten.



"The Rhodes is just the machine for us," says this company. "On small slotting and shaping jobs it is both accurate and sensitive—it has the necessary 'feel' essential to this type of work."

Photograph shows the Rhodes set up as a shaper machining a slot in a die section to a 1/8″ radius.

The "Rhodes" is supplied as a 3½″ slotter, a 7″ shaper, or as a combination machine operating in both the horizontal or vertical planes.

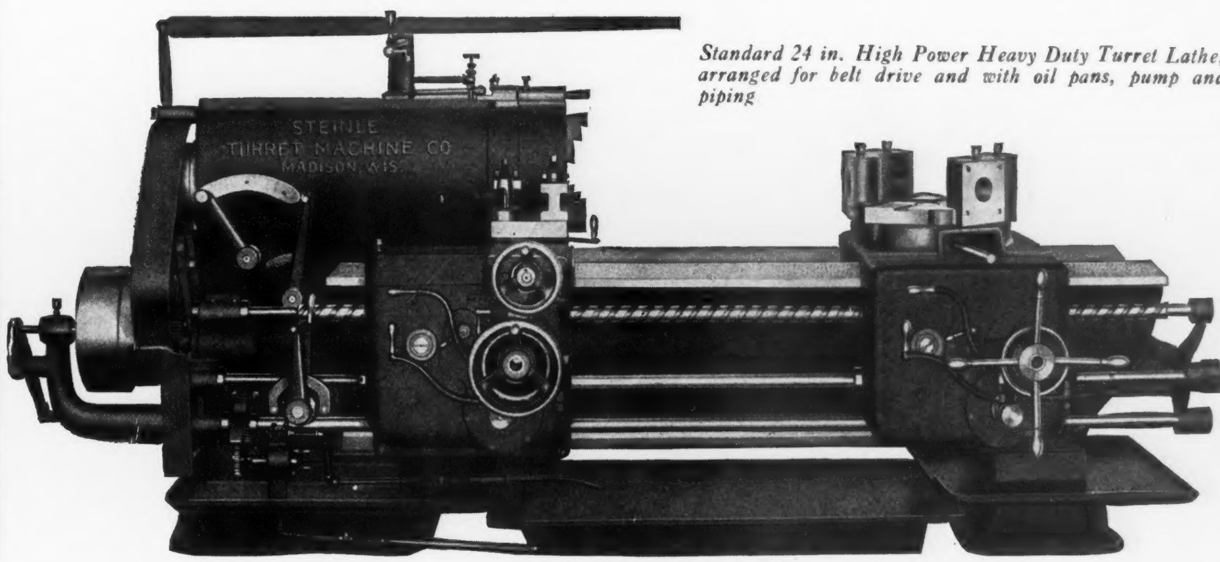
What can we do for you?

The Rhodes Manufacturing Company

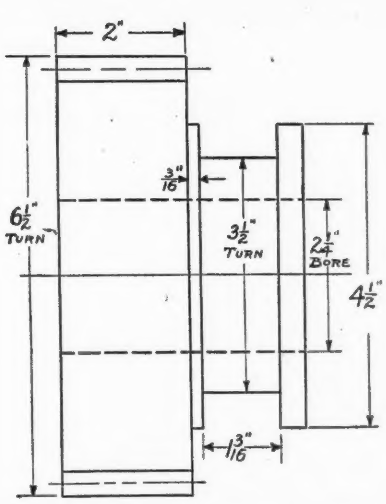
Hartford **Connecticut**

STEINLE

Full Swing Side Carriage Turret Lathes



Standard 24 in. High Power Heavy Duty Turret Lathe, arranged for belt drive and with oil pans, pump and piping



Sliding Spur Gear — Steel Forging Finish all over—Two chucking operations. TIME 15 MINUTES.

Just one of a great variety of jobs being turned out on Steinles at one of the truck and tractor plants of the International Harvester Corporation.

Why not send us your blueprints if your requirements call for the installation or equipment of this character? We shall be glad to furnish you with production and tooling estimates, or to have a qualified representative call and take up the question of Steinle methods as applied to your problems.

STEINLE TURRET MACHINE CO.

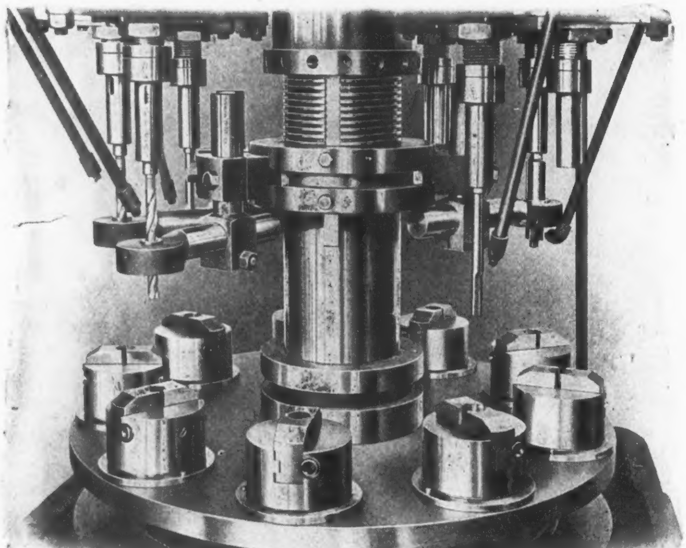
Madison, Wisconsin, U. S. A.

Originators of the Full Swing Side Carriage Turret Lathe

AGENTS—Machine Tool Engineering Co., Singer Bldg., New York City; Cadillac Tool Co., Dodge Power Bldg., Detroit, Michigan; L. G. Henes, 75 Fremont St., San Francisco, Cal., and Title Insurance Bldg., Los Angeles, Cal. FOREIGN—Leo C. Steinle, 53 Victoria Street, London, England.

SUPER-MATIC

More Operations at Less Cost



A Machine That is 300% Faster

The Supermatic combines the best features of the gang drill and the automatic screw machine with other advantages distinctively its own—including a three-way adjustment of each spindle, eliminating costly jigs; only one position for loading; individual speed for each spindle; any number of spindles up to 20 built into the machine; no skill required to operate and no setup complications.

Drills, reams, counterbores, taps, faces, etc., in a series of progressive operations and *every index means a finished part.*

Estimates from samples or blueprints. Details in catalog.

THE ACME MACHINE TOOL COMPANY

CINCINNATI, OHIO, U. S. A.

Manufacturers of Cincinnati Acme Turret Machinery

Profit by the Example of Others, Install

CINCINNATI-ACME

TURRET MACHINERY

No need to guess or experiment. Simply follow the examples of these well-known companies, all of whom use one or more Cincinnati-Acme Lathes.

Canadian Pacific Ry; Cadillac Motor Car Co; Packard Motor Car Co; Ford Motor Co; Santa Fe R. R.; Bosch Magneto Co; Chalmers Motor Car Co; C. B. & Q. R. R.; Erie R. R. Co; General Electric Co; E. I. Du Pont de Nemours Powder Co; International Motor Co; Illinois Central R. R.; Kelly-Springfield Motor Truck Co; Lincoln Motor Co; Northway Motor Co; Peerless Motor Car Co; Pierce-Arrow Motor Car Co; Pennsylvania R. R., and a long list of other concerns, equally well known.

The photograph shows one of two Acmes on the job in the Detroit factory of the Hinkley Motors Corp. Each machine is keyed up to 30 fixtures per hour. Write for the complete Cincinnati-Acme story.

The Acme Machine Tool Co.

CINCINNATI OHIO, U. S. A.

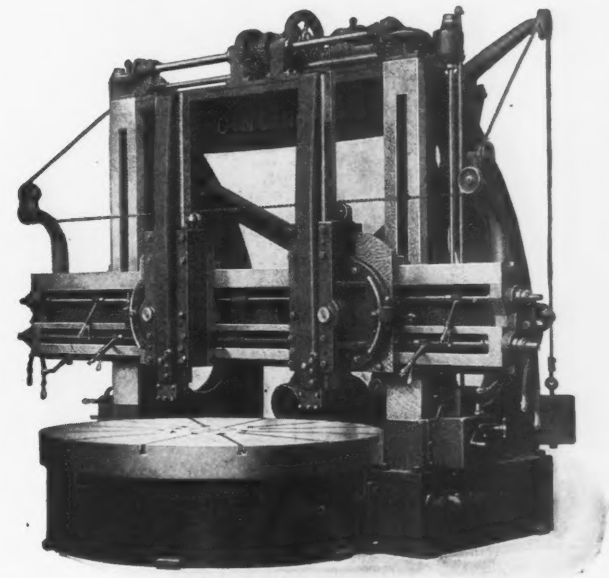
Agents in all leading cities at home and abroad

CINCINNATI

PLANERS *Original Thru out* BORING MILLS

For Better Tomorrows

buy Cincinnati Boring Mills—they have Rapid Power Traverse, Selective Speeds, Quick Change Independent Feeds for each head and Centralized Control.



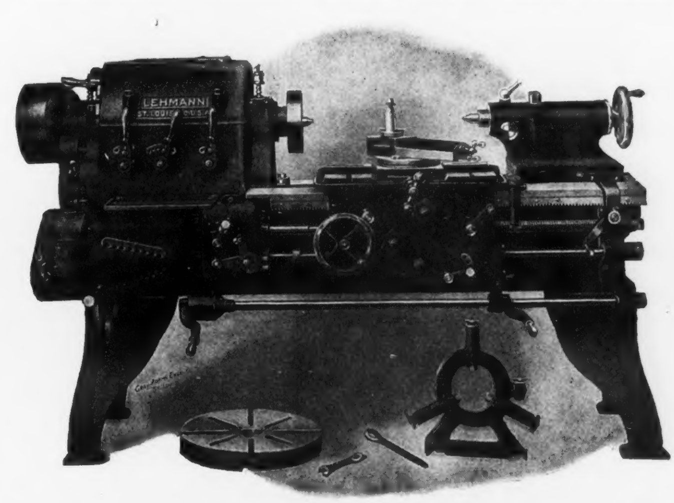
Size 42" to 12'. Cut shows heavy model.

The Cincinnati Planer Co.
Cincinnati Ohio, U. S. A.
Manufacturers of Planers and Boring Mills

The "Lehmann" Improved Selective Head Lathes

(Patents Pending) **SIZES—14" to 24" Swing**

On account of its simplicity of construction, great driving power and rigidity, ample range of speeds, moderate tooth travel of its gears, compact and shapely appearance, the "LEHMANN" Selective Head Engine Lathe stands today in a class *ahead* and *alone*. Some of the features of construction are:—



Sixteen Spindle Speeds in correct geometrical progression obtained with the use of only *ten* gears.

Improved Friction Clutches (Patents Pending) running in oil, requiring no adjustment and giving forward and reverse control of spindle.

Heat-treated or Hardened Steel gears.

All Shafts, except spindle, running on ball bearings.

Spindle of alloy steel, hardened and ground at the bearings and running in phosphor bronze boxes.

Head Casting forms oil-tight case enclosing all running parts.

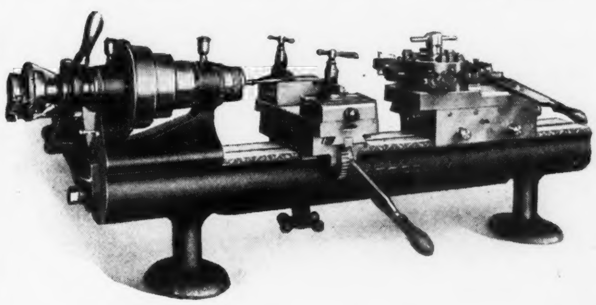
In addition these lathes embody all features such as the patent quick change mechanism, the tailstock spindle locking device, the rod and screw shift, etc., forming part of the "LEHMANN" Cone Head Lathes which have acquired an enviable reputation for accuracy and production.

Let us Describe more fully this Exceptional Lathe and its Distinctive Advantages

LEHMANN MACHINE COMPANY, St. Louis, U. S. A.

CHOUTEAU AVENUE at GRAND

Potter Bench Lathe



A Machine Shop in Miniature

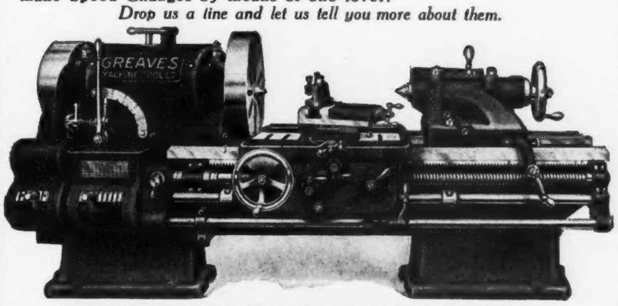
The Potter 7" Precision Bench Lathe is equipped with double cross-slide, lever tailstock, large and small turrets, improved lever chuck closer and internal and external grinding attachments. A two- or three-speed grinding countershaft is supplied, in addition to thread cutting and milling attachments. Durably constructed, well balanced, easily controlled; the Potter can safely be speeded up for the highest type of precision production.

Write for Catalog No. 10.

S. A. Potter Tool & Machine Works
77 E. 130th Street **New York City**

Why Have a Multiplicity of Levers for Making Speed Changes, When the Same Can Be Accomplished By One?

Levers confuse the operator, besides making a machine complicated.
GREAVES GEARED HEAD LATHES Start, Stop, Reverse, and make Speed Changes by means of one lever.
Drop us a line and let us tell you more about them.



THE GREAVES MACHINE TOOL COMPANY
2116-22 Colerain Avenue **Cincinnati, Ohio, U. S. A.**

The Automatic Machine Company

BRIDGEPORT **CONNECTICUT**

Makers of

AUTOMATIC THREADING LATHES
AUTOMATIC HOB THREAD MILLERS
COULTER MULTIPLE SPINDLE PROFILERS
COULTER SHAPING PLANERS
SPECIAL MACHINE TOOLS

CARROLL **10½" UNIVERSAL INDEX CENTERS**

Used on Leading Milling Machines. For all requirements. Strong-Rigid-Quick-Accurate. We can furnish this tool either Right or Left Hand type. All parts are interchangeable. Write us to-day for details.

WM. CARROLL & SON
Manufacturers
4220 Main Avenue
(Norwood) Cincinnati, O.

PHOENIX

TURRET ATTACHMENTS

Tipping or Shearing Positively Prevented

Phoenix Turret Tool Posts represent the standard of value in turret attachment for engine lathes. This is not alone based on the quality of materials and workmanship but also by the dependable service they render and the strictest shop economy they make possible.

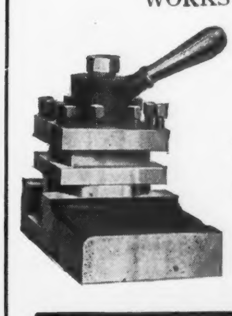
One of many important exclusive Pheonix features is the ease with which each Pheonix Turret Tool Post is attached to the engine lathe and the rigid locking device which positively prevents any tipping or shearing of the attachment.

Satisfy Yourself -- Get the Facts

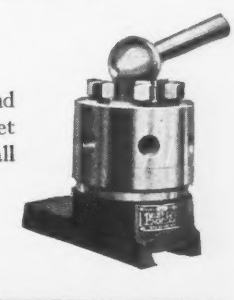
Prove to yourself that your engine lathes equipped with Phoenix Turret Tool Posts will give you turret lathe efficiency at engine lathe cost. Send today for new, illustrated folder which gives you all the facts and shows every style post we manufacture.

PHOENIX MANUFACTURING COMPANY
WORKS: EAU CLAIRE, WISCONSIN

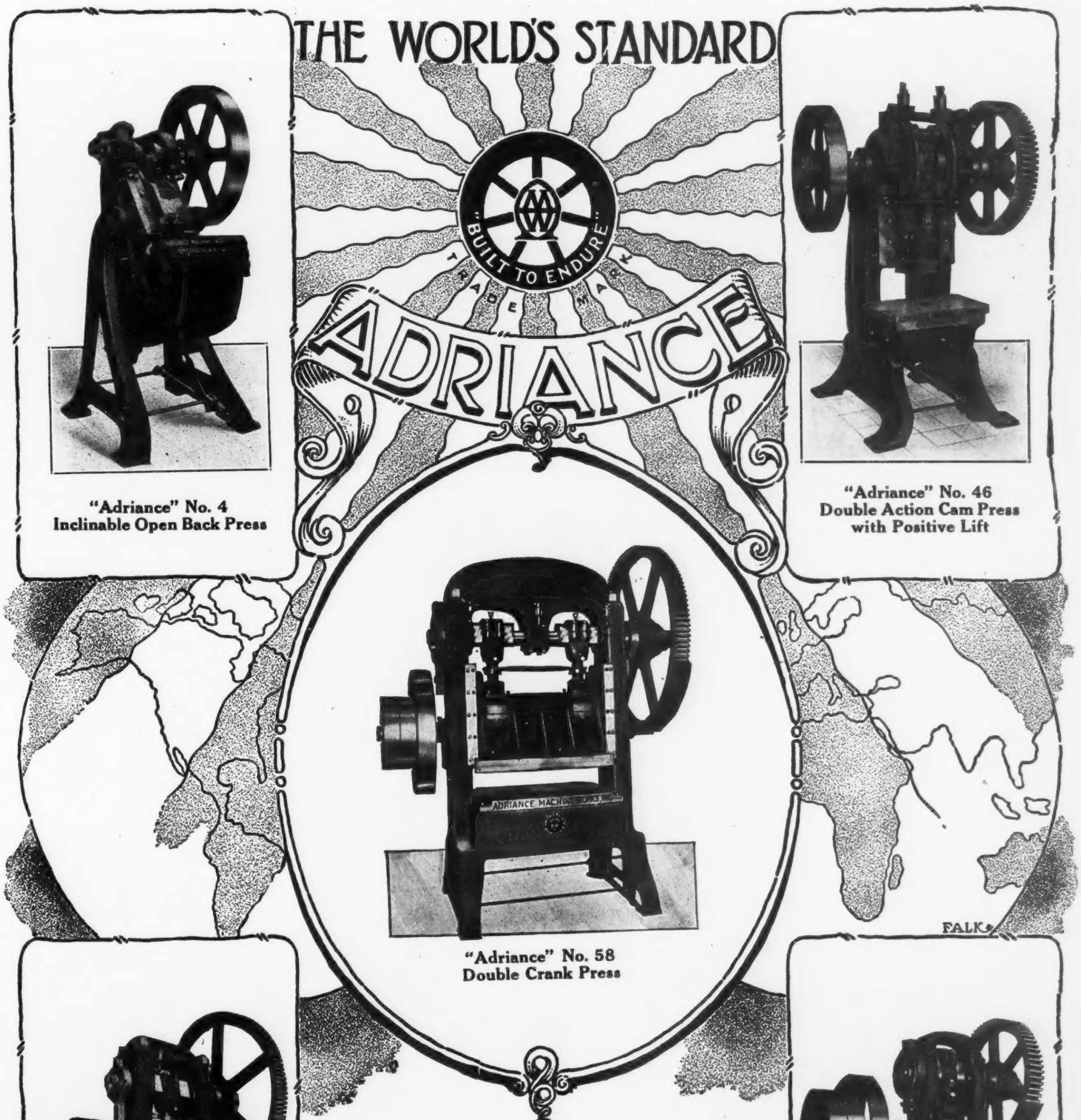
Dept. M8

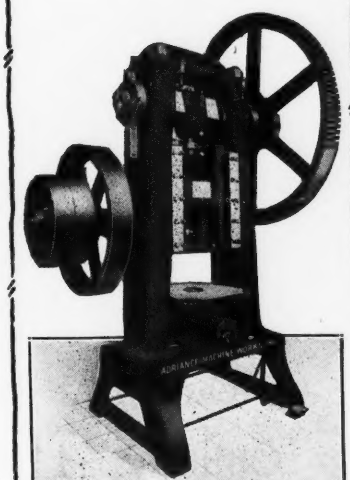


There is a size and style Phoenix Turret Tool Post to suit all lathes and purposes.

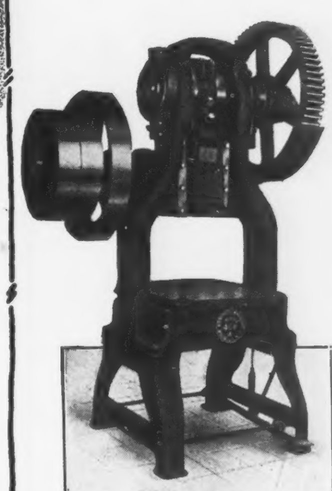


Known & Trusted Since 1861





"Adriance" No. 67A
Straight Side Press



"Adriance" No. 406A
Arch-Power Press

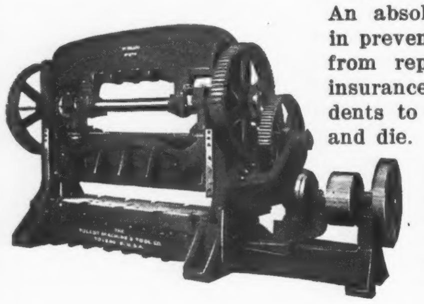
THE "TOLEDO"

DOUBLE CRANK PRESSES

All Sizes—All Weights—for All Purposes

The cut shows a press of this type especially designed for narrow channel blanking and forming; this machine can be fitted with power elevator for raising and lowering the sides.

All Toledo Power Presses equipped with automatic clutch can be fitted with a special Positive Automatic Safety Lock. An absolute safeguard in preventing the press from repeating—safety insurance against accidents to both operator and die.



No matter what your stamping work, there's a Toledo Press to do it.

The Toledo Machine & Tool Company

Toledo, Ohio, U. S. A.

Chicago Office: Room No. 608 Machinery Hall, 549 West Washington Boulevard.

An Arbor Press

of Unusual Power and Range

Price $31.00

Details on request

You can see at a glance that this No. 3 press is rugged and strong; that the throat is deep (13") to accommodate large work, the ram extra large and heavy—1½" by 1½" by 17"—and the lever amply long to obtain leverage. We build only the one size (in bench and pedestal types) and concentrate all our efforts on making it right in every way.

K. R. WILSON

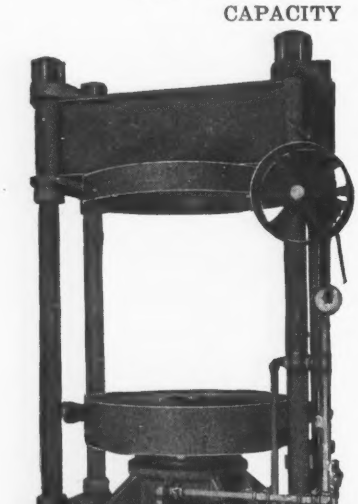
10 Lock Street Buffalo, N. Y.

Hydraulic Presses

FROM

100 to 300 TONS

CAPACITY



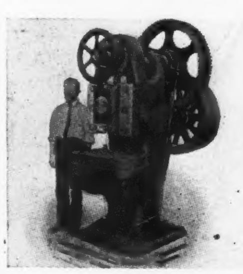
Rochester Helve Hammers

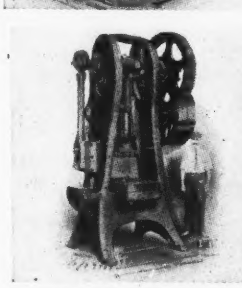
West Hydraulic Tire Setters

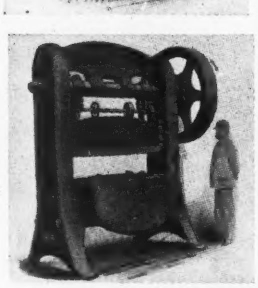
THE WEST TIRE SETTER CO.

Rochester, New York

FERRACUTE







PRESSES

FOR

Cutting,

Forming,

Drawing,

Punching,

Shearing,

Coining and

Embossing

METALS

FERRACUTE MACHINE CO., BRIDGETON, NEW JERSEY

SWAINE

Metal Working Machinery

Strong—Speedy—Safe

Swaine Presses are particularly noted for their strength, speed and safety. Designed by skilled engineers with the cumulative manufacturing experiences of half a century behind them, they are recognized as the last word in metal working equipment.

Among their important features are vanadium steel shaft and clutch parts, self-oiling bearings, automatic safety lock and improved slide adjustment graduated to .001″.

Swaine Metal Working Machinery is made for a multitude of purposes.

Write for particulars.

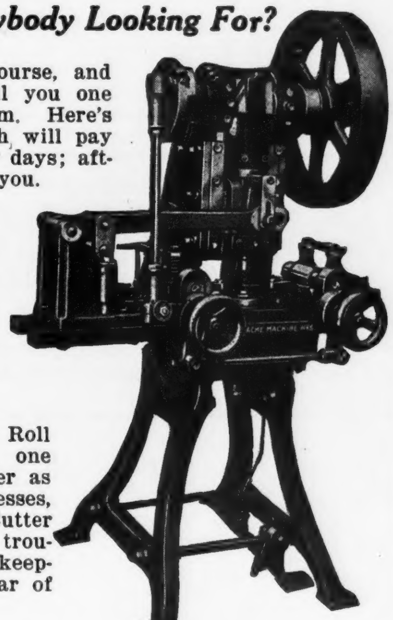
Fred. J. Swaine Mfg. Co.

Seventh and O'Fallon Streets

ST. LOUIS MISSOURI

ACME ROLL FEEDS

What is Everybody Looking For?



Lower costs, of course, and we're going to tell you one way of finding them. Here's an appliance which will pay for itself in ninety days; after that it will pay you.

The Acme Roll Feed and Scrap Cutter will turn your hand fed punch press into a modern automatic—will double or treble your production.

With the Acme Roll Feed attachment one man will look after as many as three presses, and the Scrap Cutter will save him the trouble and danger of keeping the tables clear of waste stock.

If you handle ribbon stock the Acme Roll Feed will revolutionize your production. Put yourself in possession of the full facts.

F. J. LITTELL MACHINE CO.

SUCCESSORS TO

ACME MACHINE WORKS

4125 Ravenswood Avenue Dept. B CHICAGO, ILL.

Hydraulic Presses

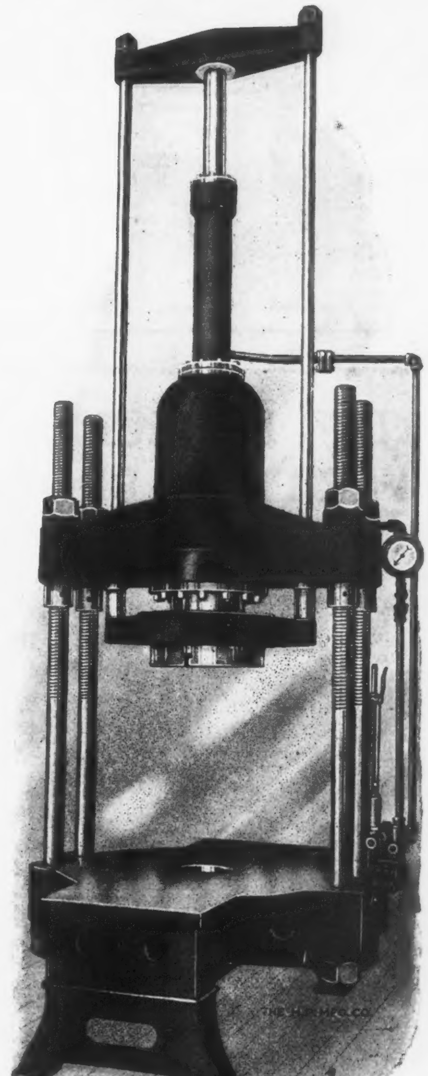


FIG. 1151.

A Forty-four Year Record of Satisfactory Service

The advantages of the Hydraulic Press over all other types are so apparent and established that comparisons are superfluous. Since 1877 we have been designing and perfecting Hydraulic Machinery and adapting it to the needs of hundreds of industries. We make Hydraulic Presses and Machinery for every conceivable purpose. Our product is in use all over the world and is making good.

Write for our Catalog.

THE HYDRAULIC PRESS MANUFACTURING CO.

America's Authority on Hydraulic Machinery

Mount Gilead, Ohio, U. S. A.

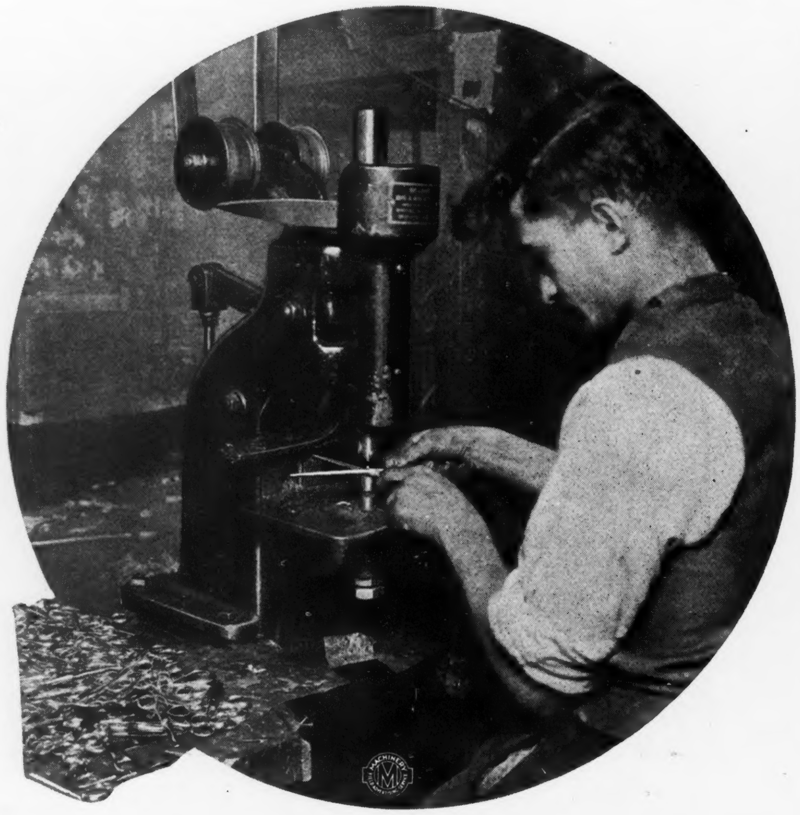
New York Buffalo Detroit Cleveland San Francisco

"For Your Pressing Needs"

GRANT
RIVETING
Fine Shears

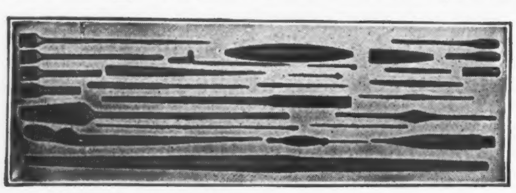
Setting durable rivets that will not work loose or bind; that will guarantee the durability of the shears as long as the blades can be used. Production is good, the finish excellent.

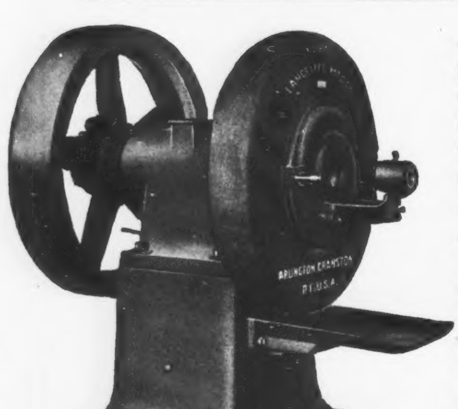
Grant Riveters work easily and almost noiselessly and are rarely out of order. If you set tight or loose rivets in any class of work ask us about these machines.



Grant Manufacturing and Machine Company
BRIDGEPORT N. W. Station CONNECTICUT

ROTARY SWAGING
The MODERN METHOD of Accurately Forming Metal with ECONOMY





The function of these machines is the reduction sizing or tapering of metals of round, square, hexagonal or other section to a circular section either solid or tubular and hot or cold by power actuated dies striking up to as many as 3000 blows per minute.

Our policy is to equip the machines in every detail with work holders and feeding devices that will enable them to give the most efficient service at low upkeep expense when operated by unskilled labor.

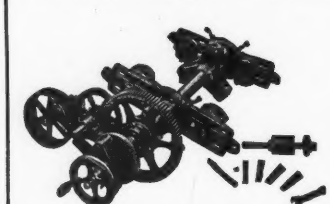
Machines built up to date, have capacities ranging from a pin point up to 2½" diameter on solid stock and up to 5½" on tubing.

LMCo.

LANGELIER MFG. COMPANY
Arlington, Cranston, R. I., U. S. A.

When You Overhaul Your Plant

this year, don't dismantle the engine. You can rebore cylinders, valves, etc., *in place* with the



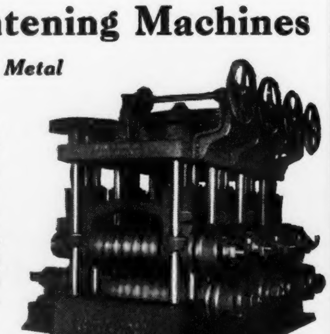
UNDERWOOD PORTABLE BORING BAR

It's one of the handiest of our many handy tools. Write for catalog.

H. B. Underwood Corporation
PHILADELPHIA (Est. 1870) PENNA., U. S. A.

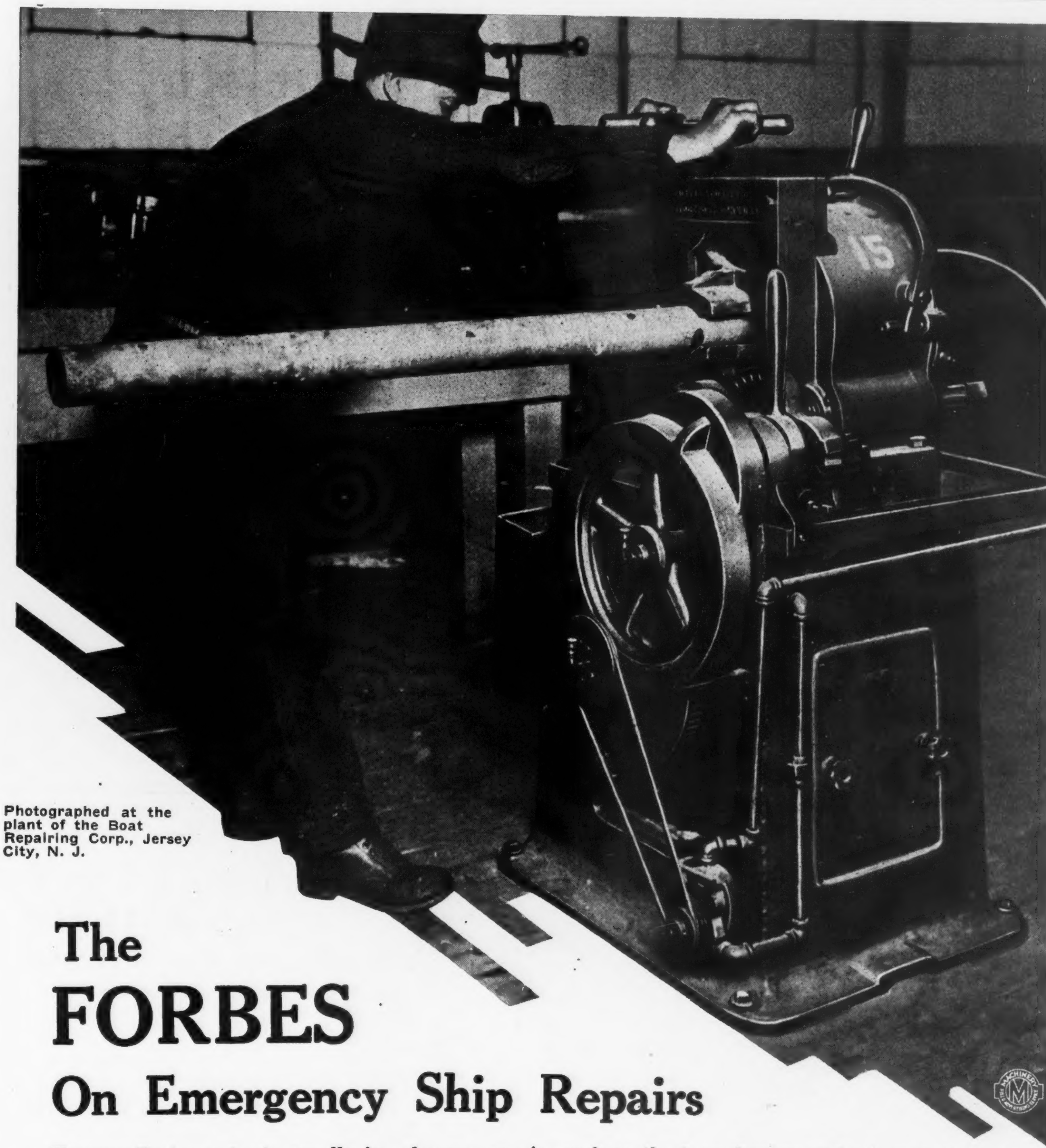
K & R Straightening Machines
For any size or Shape of Metal

Built in diversified styles and sizes to straighten Rounds, Squares, Flats, Angles, Channels, I-Beams, Tubing, Pipe, Sheets, etc. Also machines for straightening stock from the coil and automatically cutting to lengths. Write for Catalog.



No. 6 Straightener

KANE & ROACH
Syracuse (Est. 1887) N. Y.



Photographed at the plant of the Boat Repairing Corp., Jersey City, N. J.

The FORBES

On Emergency Ship Repairs

Frequently important, usually in a hurry, repair work on the tugs, barges and other craft that come to this Jersey City shipyard gives plenty of opportunity for this busy Forbes to show its mettle. Simple, compact and self-contained, it is *portable*—and works equally well in its place in the shop or on shipboard, where it can easily be taken to thread and cut the pipe without dismantling the work.

Send for our catalog. Let us tell you how the Forbes works and where the difference lies. Sizes to take pipe 16″. Belt or motor drive or hand operation.

CURTIS & CURTIS COMPANY, 324 Garden St., Bridgeport, Conn.

FOREIGN AGENCIES: Andersen, Meyer & Co., Ltd. of China, Shanghai, China. Horne Company, Ltd., Tokyo, Japan. Aktiebolaget Sigfr. Anderson & Co., Malmo, Goteborg, Scandinavia and Stockholm, Sweden.

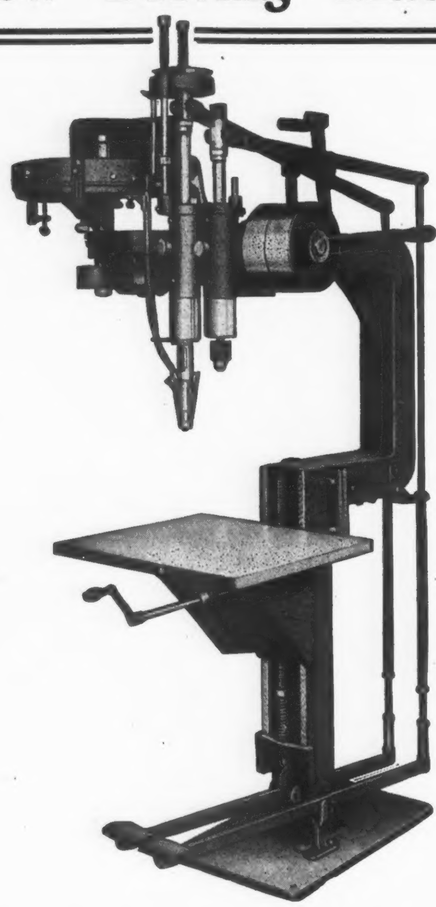
FORBES'

30° 30°

IT THREADS PIPE ACCURATELY

Don't Waste Time and Money Driving Screws by Hand

Reynolds Magazine Fed Screw Driving Machine



Drives machine screws, wood screws, stove bolts, hex head or square head bolts, or most anything that can be magazined.

Follow the example of your competitors and install Magazine Fed Screw Driving Machines

The Reynolds Machine Co.
Dept. M (Information)
MASSILLON OHIO, U. S. A.

Hurlbut-Rogers Broaches

The cutting quality of the broach and the amount of work it will do without regrinding, practically control the costs of the broaching operation.

Hurlbut-Rogers Broaches—made by a special process that insures a tough core and keen cutting edges—give the kind of service that makes broaching profitable.

We make them for all kinds of work and guarantee deliveries.

Send us blue-prints of your work, we'll be glad to quote prices.

The Hurlbut-Rogers Broach Company
HUDSON MASS., U. S. A.

BEAUDRY HAMMERS

For General Forging

Save Fuel, Time and Labor. Cut Forging Costs in Two.

Belt or Motor Driven

BEAUDRY & CO.
Incorporated
45 Bromfield St., Boston 9, Mass.

MERRELL Pipe Threading and Cutting Machinery

Hand or Power Operated

THE MERRELL MFG. COMPANY
15 Curtis Street TOLEDO, OHIO

CHAMBERSBURG HAMMERS

STEAM DROP—BOARD DROP—SINGLE AND DOUBLE FRAME TYPES

All Sizes for Every Class of Forging Work

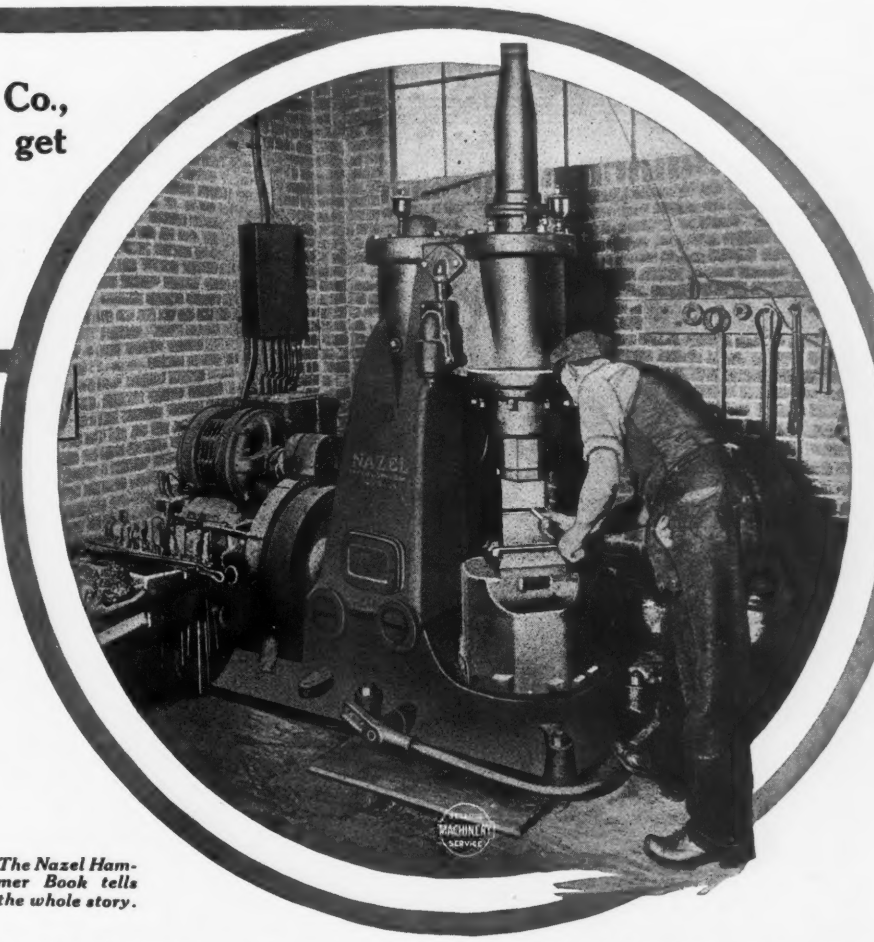
HYDRAULIC MACHINERY

CHAMBERSBURG ENGINEERING CO., Chambersburg, Pa.

Send for Catalog

The Lange Motor Truck Co., of Pittsburgh, "Couldn't get along without" this

NAZEL HAMMER

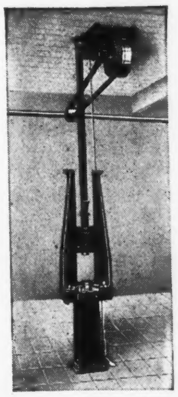


The machine is extensively used in forming wind guard irons, cab stays, headlight brackets, yoke ends and other automobile forgings, as well as for tool dressing.

It's a fully self-contained, one man production unit, motor driven, foot controlled and compresses its own air; is entirely independent of shafting and steam connections. "More blows per beat" is its motto—the blows having a distinctly positive and "clinging" quality which adapts the hammer to a wide range of work.

The Nazel Hammer Book tells the whole story.

NAZEL ENGINEERING WORKS, 4043 North 5th Street **PHILADELPHIA, PA.**



"PECK"

Automatic Drop Lifters

will convert those hand or foot drops and unsatisfactory automatics into

PRODUCTIVE AUTOMATIC DROPS

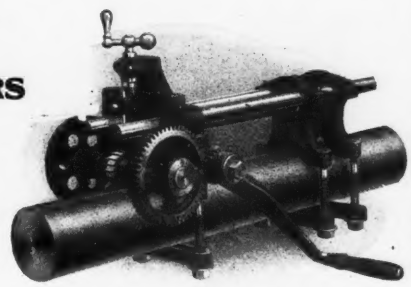
Capacity 15 to 5000 pounds

DROP PRESSES for all purposes

MINER & PECK MFG. CO.
DERBY, CONN.

Cut Keyseats Quickly In Any Position

BURR PORTABLE SHAFT KEYSEATERS

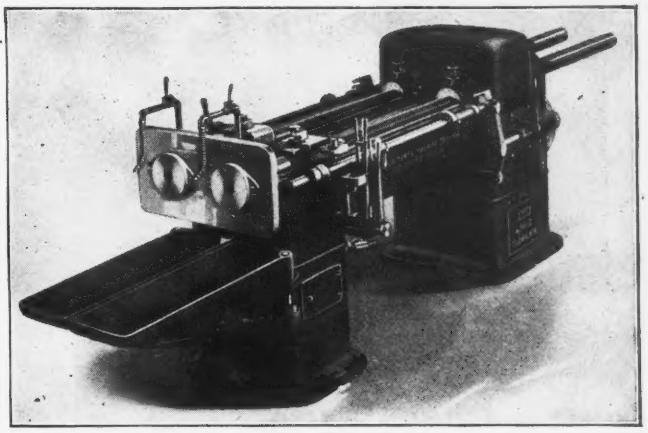


This one cuts accurate keyseats to 12" long in shafting up to 5" in diameter without resetting.

Hand or motor drive.

Catalog gives details and list of sizes.

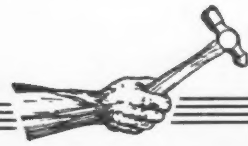
JOHN T. BURR & SON, 432 KENT AVENUE BROOKLYN, N. Y.



Lapointe Broaching

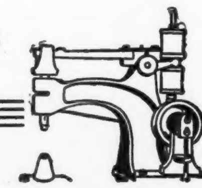
Have you ever thought that broaching might be the "way out" on that intricate shape that threatens to make your new machine too expensive? With Lapointe Machines and Broaches this process is a practical *economical* way to cut duplicate outlines on many classes of work. Ask us about it.

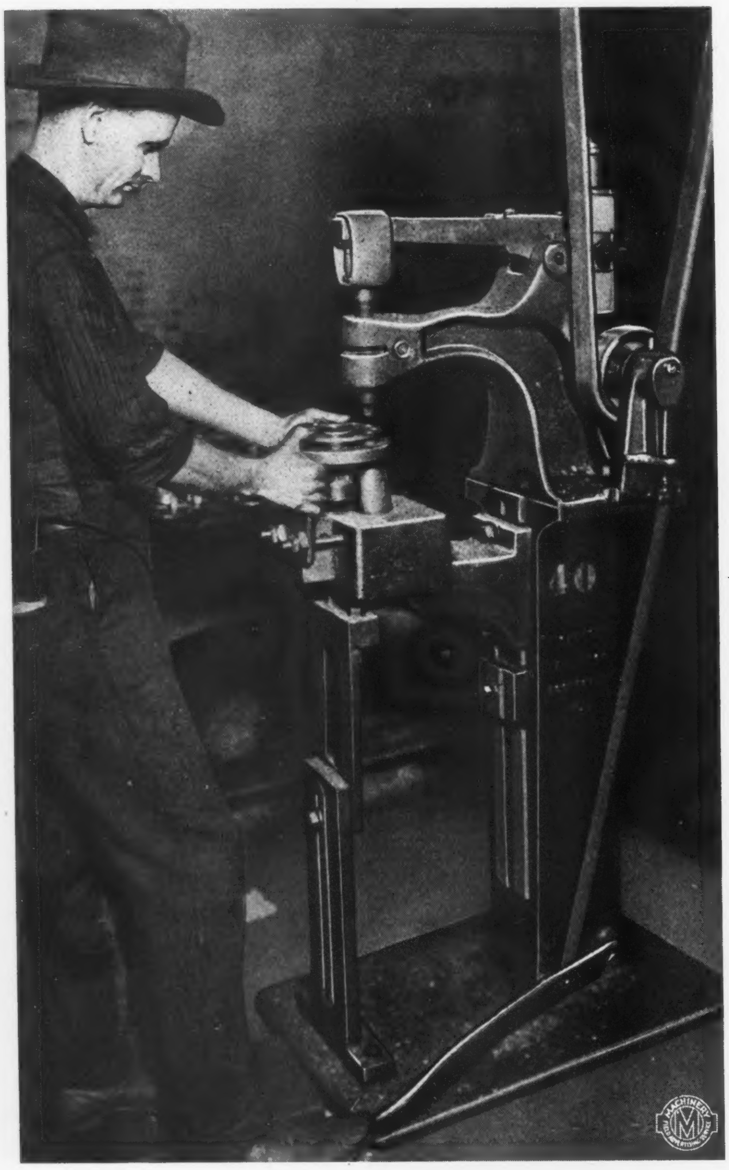
The Lapointe Machine Tool Co.
HUDSON MASS., U. S. A.



THE PRINCIPLE IS RIGHT

THE HAMMER WITH THE HUMAN STROKE





HIGH SPEED RIVETING HAMMERS

(PATENTED)

Another of the Many Ways they Serve the Automotive Industry

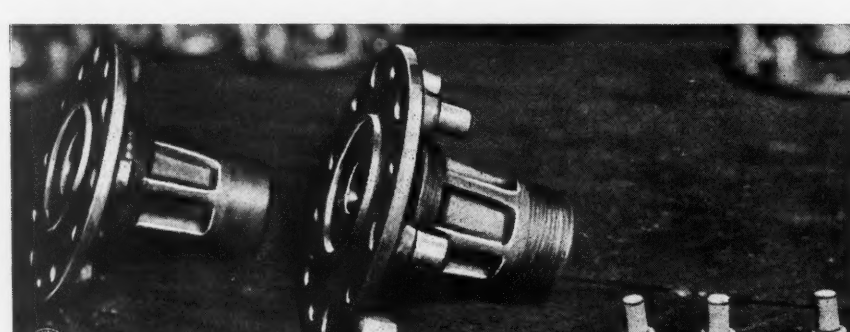
One of the busiest machines in the plant of the Dayton Wire Wheel Company is this four-year-old High Speed Riveting Hammer, used for riveting pins in wire wheel hubs.

Six steel pins, 3/8" diameter at the end that is riveted, are pressed into holes of corresponding size on the hub flange, a fixture plate holding them in position for riveting.

Above is seen the work in progress; below the hubs before and after riveting. Seventy-five of the Hubs are handled each 60 minutes, or a total of 450 rivets are headed per hour.

Send sample parts of your work to be riveted and returned for your inspection.

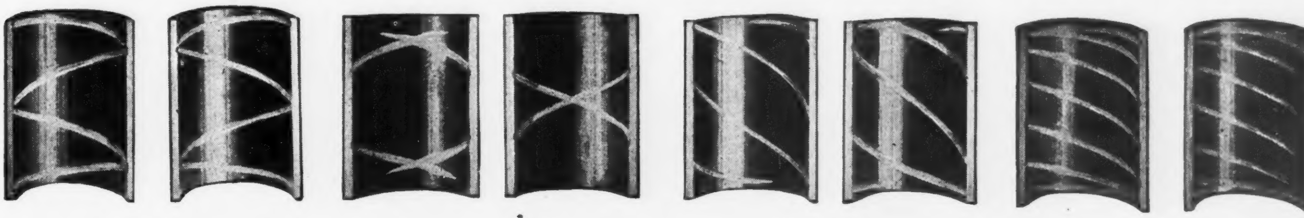
Production 450 Pins Per Hour in Wire Wheel Hubs



THE HIGH SPEED HAMMER COMPANY, Inc.

Rochester New York, U. S. A.

CHICAGO BRANCH: C. W. Schuchardt, Mgr., 568 W. Washington Boulevard. AGENCIES: Burton, Griffiths & Co., Ltd., London, E. C., for the British Isles. Aktiebolaget Rylander & Asplund, Stockholm, Sweden, for Sweden and Finland. China, Japan and South American Trading Company, Ltd. Yokohama, Kobe and Osaka, Japan, for Japan and Dependencies.



Consider the Matter of Oil Grooving!

The Sacrey Universal Oil Groover is 100 to 300 Per Cent Faster

Driven from line-shaft or by ¾ H. P. constant speed motor.

You can increase output and reduce the cost of oil grooving all kinds of cylindrical and odd-shaped parts with the Sacrey Oil Groover. Any kind of work and any combination of grooving—inside or outside. No skill and little floor space required.

Work is entered from the top and centered automatically by a three-jaw chuck or special fixture. Machine is fully self-contained, controls are all within easy reach and the design is such that *the work does not revolve.*

Hand feed is used for small jobs, power feed for production, in which case all the operator need do is to chuck and unload the work as the machine is practically automatic.

Details of this machine and its application on request, also sample bushing

NOTE—We are always glad to oil groove samples and return them with time and cost estimates, without obligation.

Philadelphia Eng. & Mch. Co., Phila., Pa. Please send me, without obligation, a sample bushing oil grooved on the Sacrey Machine—with record of grooving time.

Name......................................

Position......................................

Company......................................

City......................................

State......................................

M-8-21

The Philadelphia Engineering & Machine Company

1130 Race Street PHILADELPHIA, PA.

Machine Shop Efficiency and Lubrication

Supervision of the work in the shop to keep men and machines working at full capacity is the golden rule.

But the machine must be in a position to respond fully. There is where correct lubrication—the Texaco kind—enters. We say Texaco kind advisedly, for we have the proof—the only proof that counts—RESULTS—to back this up.

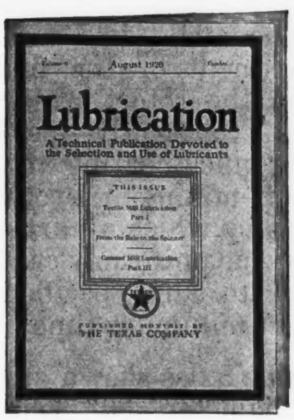
Texaco Shop Lubricants have a record of performance in shops of all kinds, and numbers of builders of machine tools and equipment, such as lathes, planers, boring mills, drills, presses, cranes, etc., recommend Texaco lubricants, because they are satisfied that Texaco will aid the showing of the machines they make and sell.

Supporting and enhancing the excellence of Texaco Shop Lubricants is the service of Texaco Lubrication Engineers.

Our staff includes experts on shop lubrication, who will make a survey of your shop and tell you which Texaco Lubricants to use for the various machines and parts.

Through efficient recommendation it is more than likely that they will be able to show you how to do the work with fewer lubricants.

This is helpful in more ways than one. It decreases the chances of confusion; it decreases the storage space necessary; it simplifies orders on the Supply Department for oils; it assists in the better operation of machines through standardization of methods of selection and application of lubricants.



In this magazine we print, month after month, articles covering the problems of lubrication as applied to various industries.

These articles are not theoretical, but based on practical operating experience. We shall send "Lubrication" to Engineers, Executives, Buyers of Lubricants and others, who are professionally interested and who ask for it—FREE.

Let us assist you in securing topnotch shop efficiency through correct lubrication. Some of our shop lubricants are:

For General Machine Lubrication........Texaco Machine Oil

For Lubricating Cutting Tools........ Texaco Cutting Oils / Texaco Soluble Oil

For Gear and Machine Tools
Texaco Crater Compound Nos. 1, 2 and 5

There is a Texaco Lubricant for Every Purpose

Get "Lubrication" *free*

CLIP THIS COUPON

THE TEXAS COMPANY

Dept. F, 17 Battery Place, New York City

NEW YORK HOUSTON CHICAGO

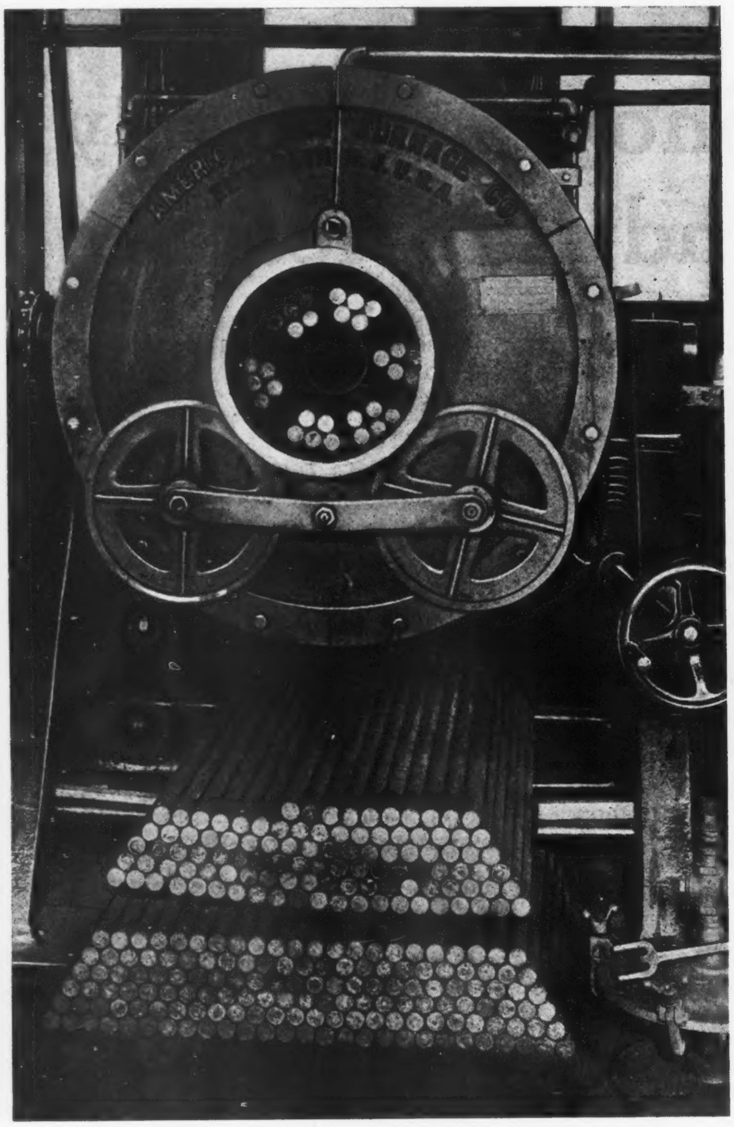
Offices in Principal Cities

Kindly put my name on your free mailing list for "LUBRICATION".

Name .... *Street*..

City.. *State* ....

8-21



Carbonizing Mine Axles—810 Pounds Per Charge

American Gas Furnaces

Products of more than 40 years' experience and specialization, American Gas Furnaces are made in a wide and practical range of styles and sizes to perform all kinds of heat-treating operations on all classes of work.

The No. 2 B Carbonizing Machine is shown arranged for carbonizing long, cylindrical parts. Several pieces of work are accommodated in each compartment of the fixture in the retort which rotates constantly—permitting quick heating and uniform mixing of work and gas by which all articles become uniformly carbonized to any specified depth in minimum time.

The mine axles shown are $1\frac{1}{2}''$ diameter, $50''$ long and weigh 27 pounds each—30 axles (810 lbs.) being considered a full charge.

American Gas Furnace Products include:

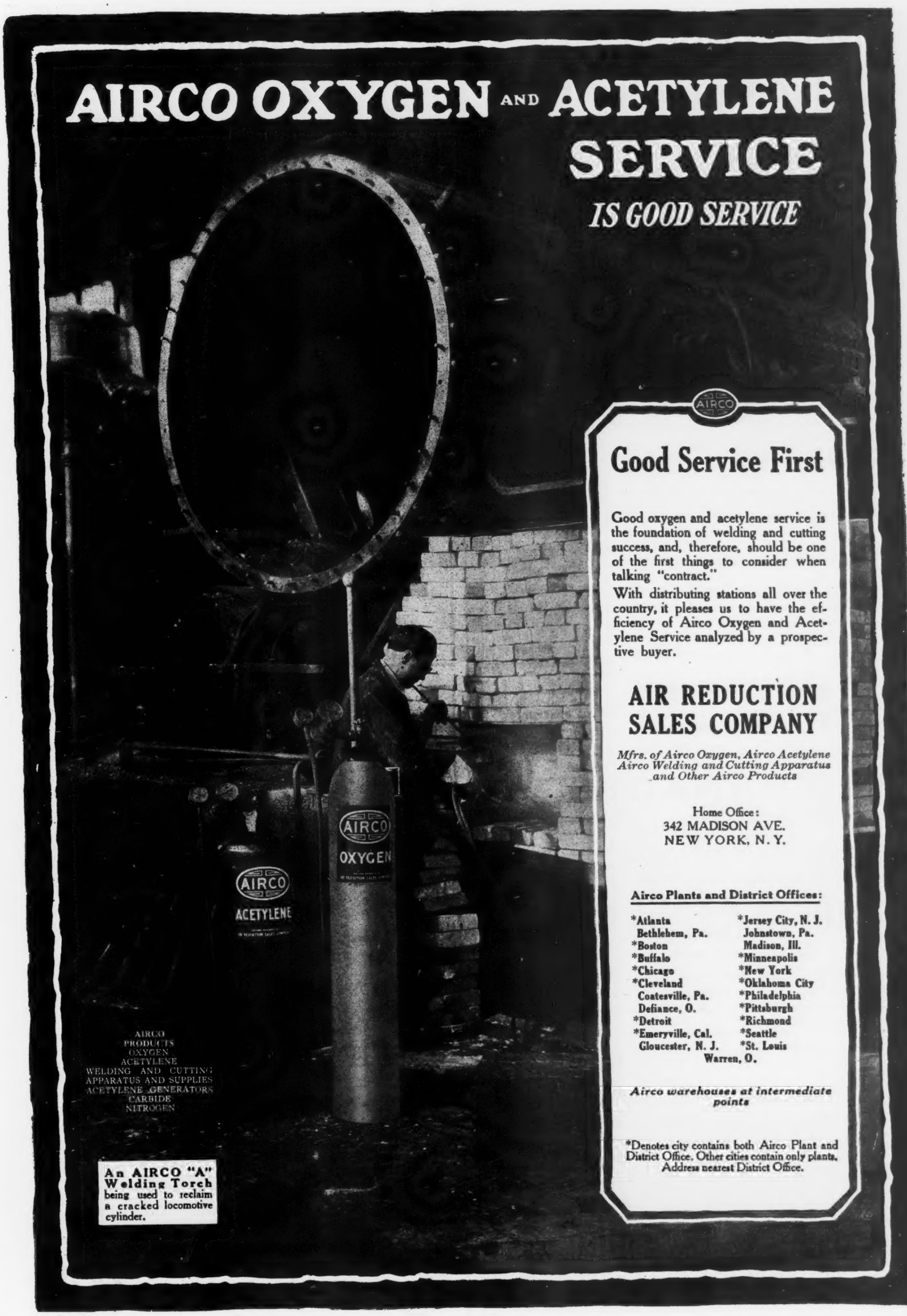
- AUTOMATIC QUENCHING TANKS
- BLOWERS
- BLOWPIPES OR BLOW-TORCHES, HAND AND STAND
- BOOSTERS, GAS
- BRASS MELTERS
- BRAZING FURNACES AND TABLES
- BURNERS
- BURNERS FOR ELECTRIC LAMP BULB MANUFACTURE
- CARBONIZING MACHINES
- CYANIDE FURNACES
- CYLINDRICAL FURNACES
- FORGES
- FORGES, GLASS BENDING
- HARDENING HAMMERS
- HEATING MACHINES
- MELTING FURNACES
- MUFFLE FURNACES
- OIL TEMPERING FURNACES
- OVEN FURNACES
- PLATING FURNACES
- RIVET HEATERS
- SOFT METAL AND LEAD HARDENING FURNACES
- SOLDERING IRON HEATERS
- SWEEP REDUCING FURNACES
- TEMPERING PLATES
- TIRE HEATERS
- TUBE HEATING FURNACES
- EVERY TYPE OF GAS BLAST BURNER, FURNACE AND HEATING MACHINE FOR INDUSTRIAL USES

Tell us your heat-treating requirements and let us prescribe.

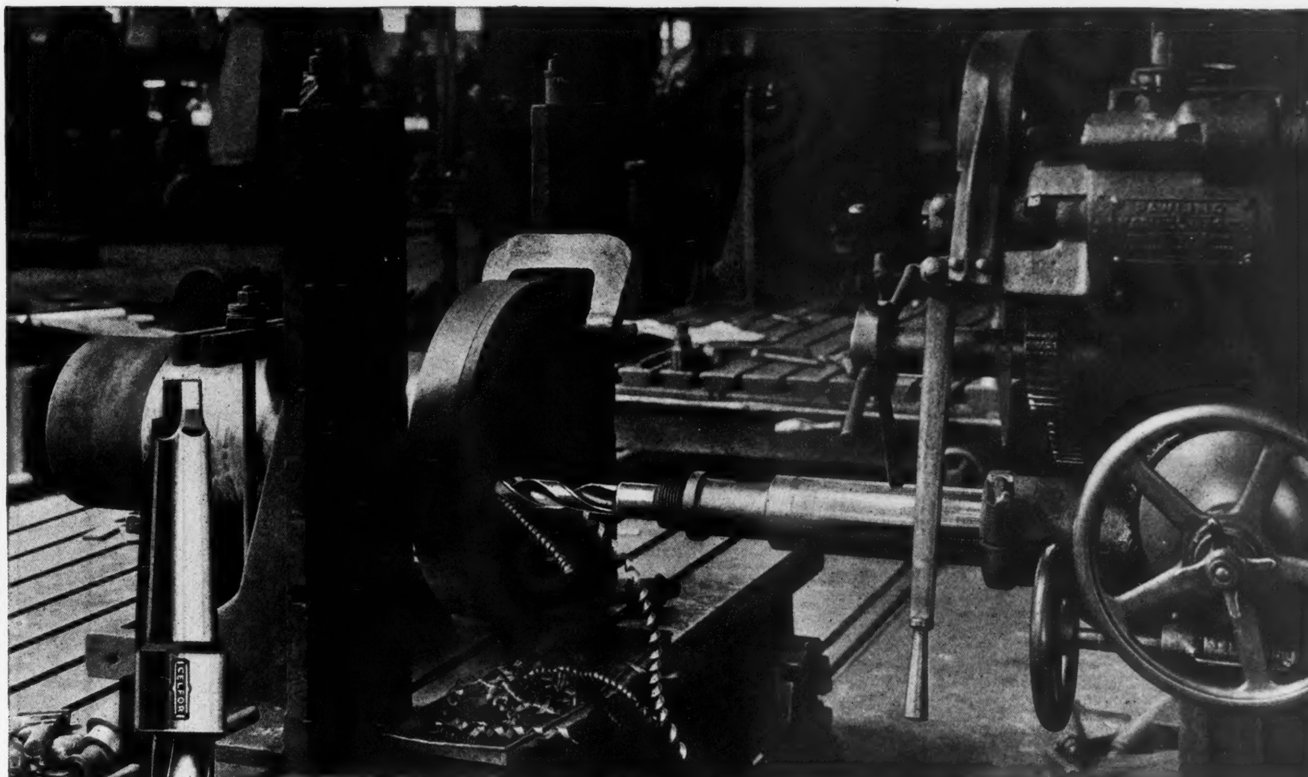
AMERICAN GAS FURNACE CO.
PIONEERS IN 1878
LEADERS TO-DAY

AMERICAN GAS FURNACE COMPANY

Main Office and Works **ELIZABETH, NEW JERSEY**



Send for Airco Booklet "The Technical Engineer's Judgment of the Oxyacetylene Process." Mention MACHINERY when writing.



The photograph shows a Celfor Drill drilling flange couplings for Diesel Oil Engine Shafts.

Diameter, 3⅜ inches; Depth, 3 inches; Feed, .0013; R. P. M., 140.

If you ever see a drill producing clean, healthy, honest-looking chips, you will find that in most cases it is a *Celfor* Drill.

Celfor Drills are known by their ability to make lots of accurate, clean-cut holes.

They are made by the Clark Equipment Co., at Buchanan, Mich.

Celfor

HIGH SPEED TWIST DRILLS

From the Latin, "Celeritas" (Speed) and "Fortis" (Strength)

FOREIGN REPRESENTATIVES:
Montreal, Rudel-Belknap Machinery Co.; Toronto, Rudel-Belknap Machinery Co.; Amsterdam, U. S. Trading Corp.; Buenos Aires, Marden, Orth & Hastings Co.; Calcutta, Tapper & Selikowitz; Christiania, John M. Larsen; Copenhagen, John M. Larsen; Gothenberg, John M. Larsen; Stockholm, John M. Larsen; London, Coats Machine Tool Co.; Milan, Weiss & Stabilini; Tokyo, Andrews & George; Paris, Moerch & Roumet.

Bunting "In Stock"

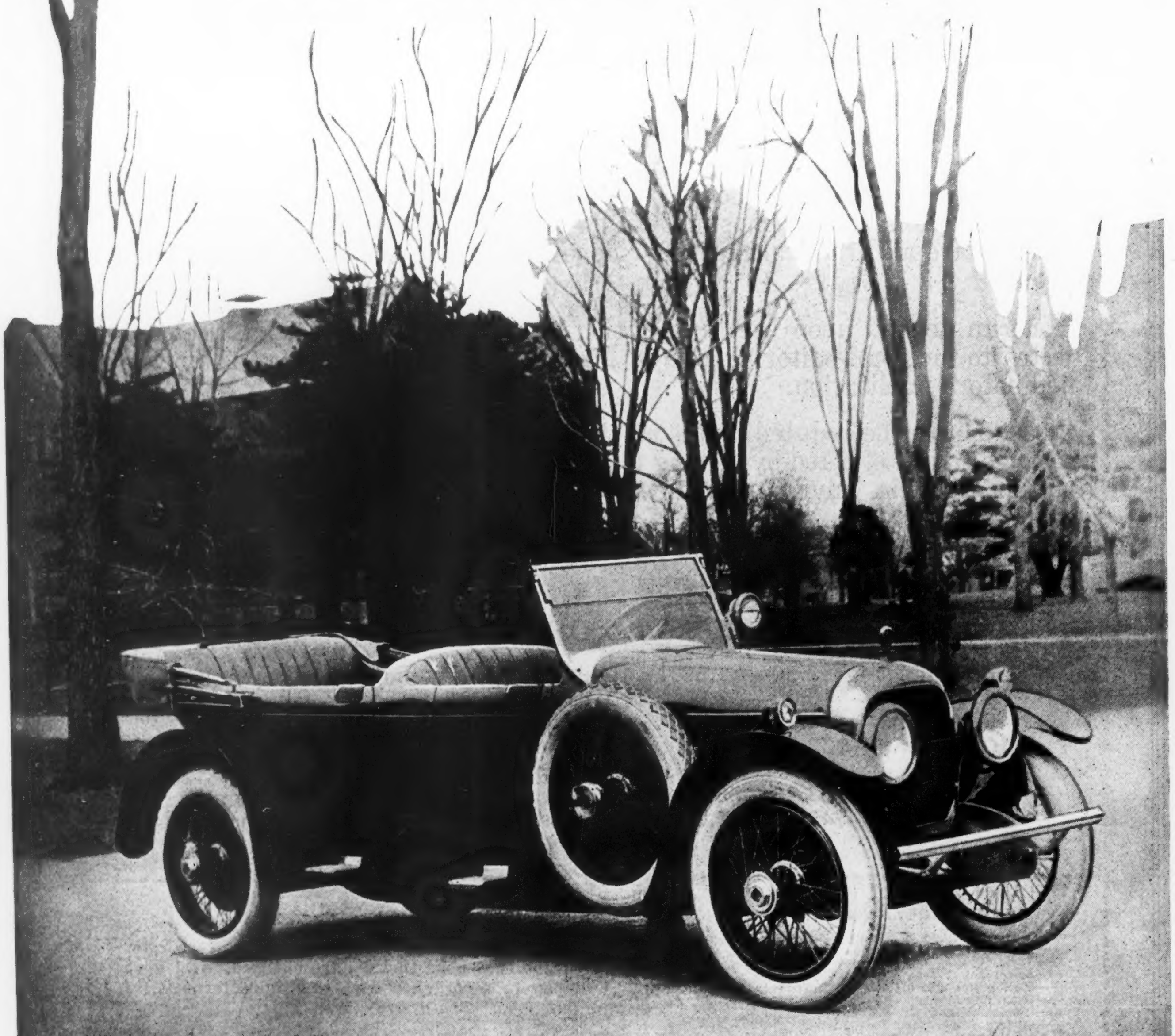
Contribute to the Enduring Perfection of Cunningham Cars

Designers and manufacturers of all mechanisms can take a lesson from James Cunningham & Sons Company, makers of an automobile that represents the very ultimate in class and quality.

Twenty-four of the twenty-nine bushings in this world-famous car are Bunting "In Stock" Bushings. They are always in stock in all Bunting Salesrooms, ready for instant delivery. Small lots are sold at big production prices.

There are 143 different sizes of these "In Stock" Bushings. Somewhere in this list are most of the plain bushings that go into your product. Often a slight change in design will put all your bushing requirements on an "In Stock" basis.

Our Stock Card "G" lists these 143 different sizes. Write for it.



THE BUNTING BRASS & BRONZE COMPANY,

New York City, Grand Central Palace
Vanderbilt 7300

Chicago, 722 S. Mich. Ave.
Wabash 9153

Finished Bushings

Bunting
Trade Mark
Reg. B B & B Co.

A 2 Rear Spring Shackle Bushings
B 1 Spring Bolt Bushing
C 2 Buffer Bolt Bushings
D 2 Buffer Bolt Spring Bushings
E 1 Transmission Shift Fork Reverse Bushing
F 2 Auxiliary Shaft Bushings
G 8 Connecting Rod Bushings
H 1 Transmission Reverse Gear Bushings
I 2 Oil Pump Bushings
J 8 Spring Bushings
Total 29 Bushings

All the Plain Bushings in This Well-known Car are Bought as needed from Buntings "In Stock" sizes.

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San Francisco, 198 Second St., Cor. Howard
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BY INVITATION MEMBER OF
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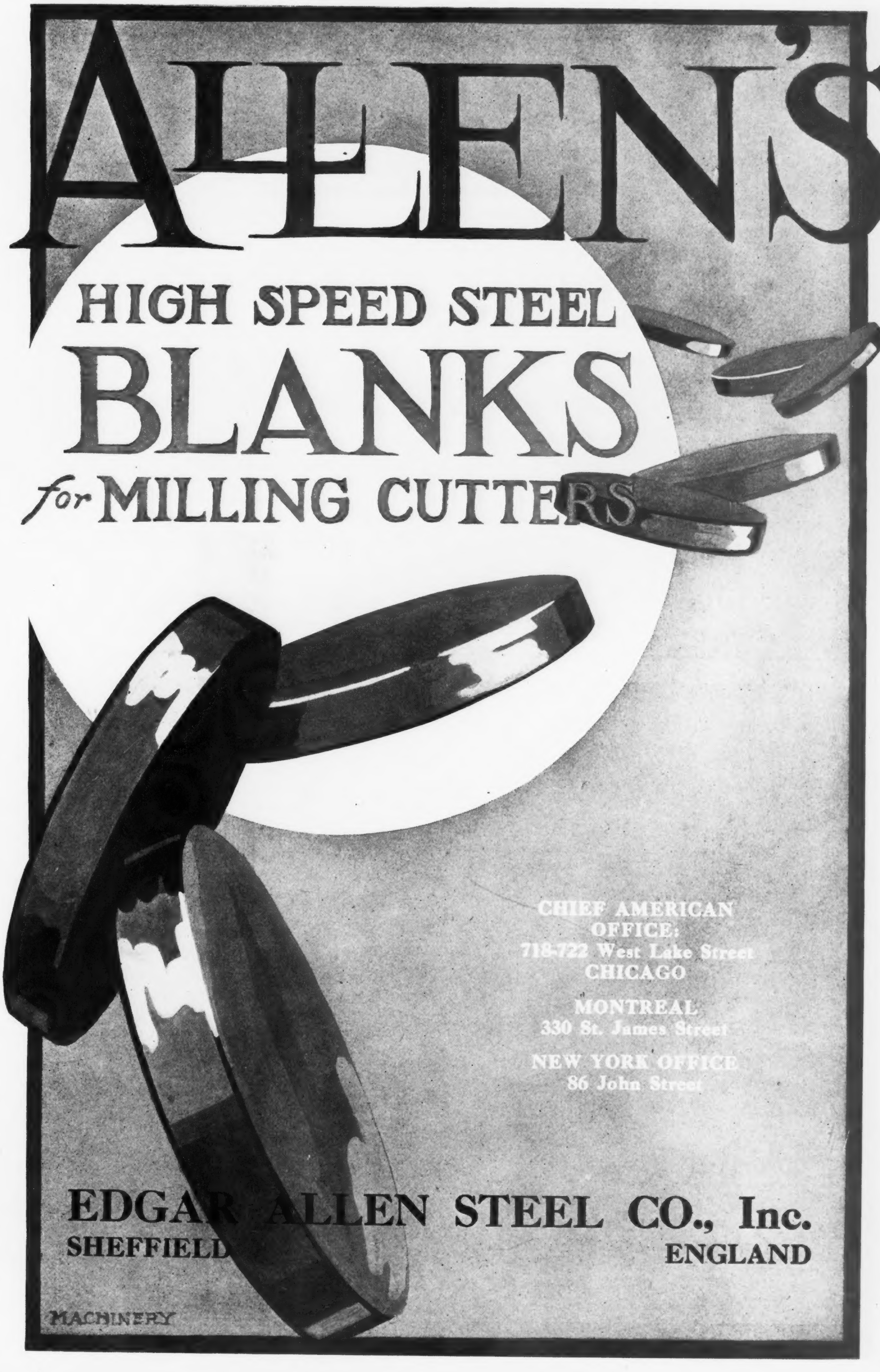
RED CUT SUPERIOR
HIGH SPEED STEEL


ALLEN'S
HIGH SPEED STEEL
BLANKS
for MILLING CUTTERS
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Yuma

BallBearing Steels
Piegan
Teton
Navaho
Kutani

Will not Move when Hardened in either Oil or Water

Here's a report direct from the firing line—

"*Utica* did not change at all on hardening. The taps were measured both before and after hardening but no difference could be detected, and the threads were as clean as before hardening. No hardening scale."

Can you make a similar report?

Specify *Utica*, the consistently uniform, non-shrinking tool steel for taps, dies, plug and ring gauges, press tools, hobs, and similar purposes.

Then your hardening worries will cease.

Shall we quote you?

Ludlum Steel Company

General Offices and Works:

Watervliet, N. Y.

"MASTERS OF THE INDUSTRY"

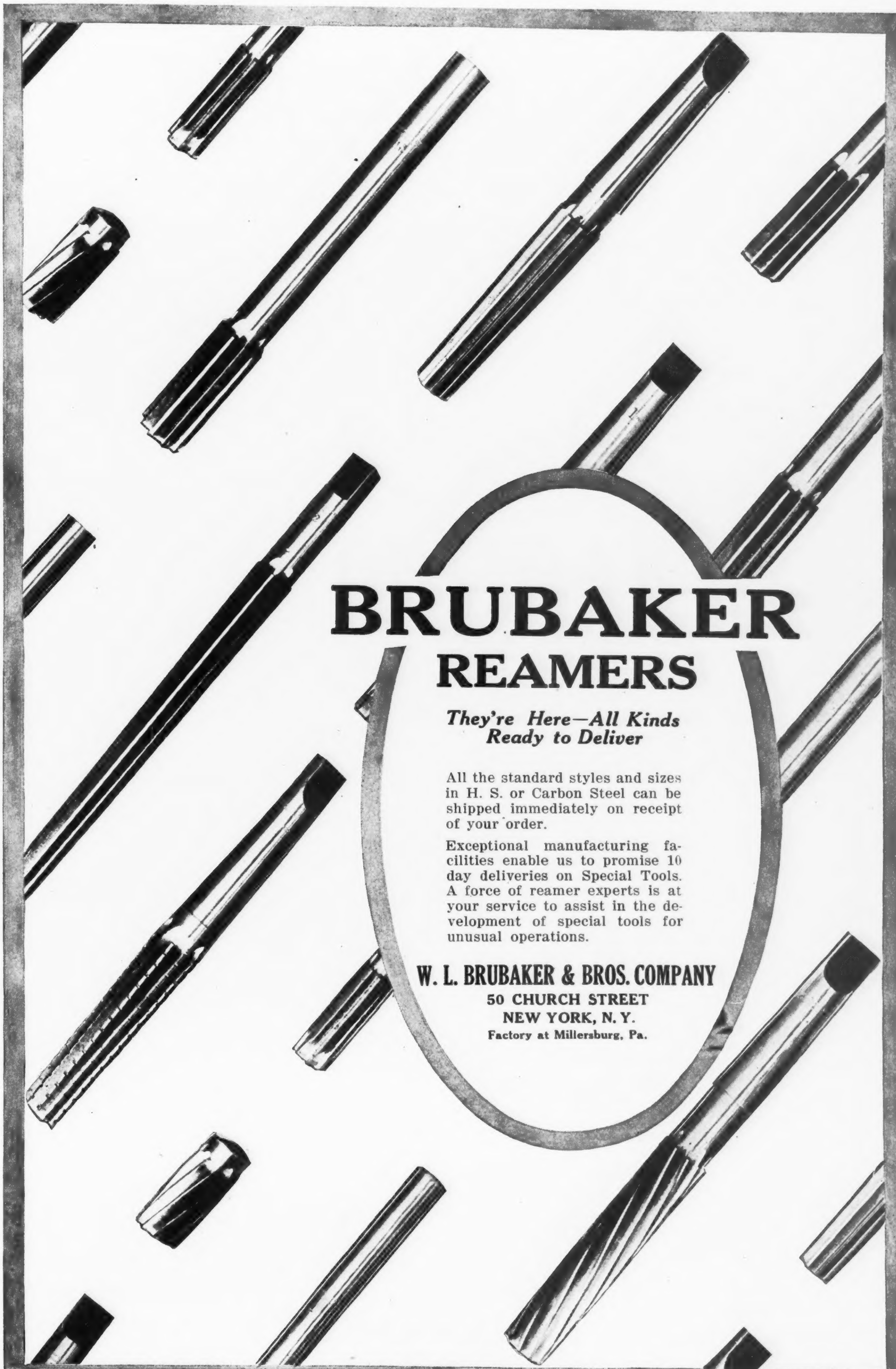
Branch Offices:

Pittsburgh	Buffalo	San Francisco
Cambridge, Mass.	Philadelphia	Cleveland
New York City	Chicago	Detroit

UTICA STEEL
LUDLUM STEEL COMPANY

WATERVLIET-N.Y.

STAFF


BRUBAKER
REAMERS
They're Here—All Kinds
Ready to Deliver
All the standard styles and sizes in H. S. or Carbon Steel can be shipped immediately on receipt of your order.
Exceptional manufacturing facilities enable us to promise 10 day deliveries on Special Tools. A force of reamer experts is at your service to assist in the development of special tools for unusual operations.
W. L. BRUBAKER & BROS. COMPANY
50 CHURCH STREET
NEW YORK, N. Y.
Factory at Millersburg, Pa.

COLLIS

JUST ANOTHER WAY OF SAYING

Quality—Accuracy—Service

No. 100-D Standard Type Sleeve

No. 100 Use-Em-Up Type Sleeve

Standard and Use-Em-Up Types

DRILL SLEEVES AND SOCKETS

CHUCK ARBORS
LATHE CENTERS
LATHE BUSHINGS
LATHE SOCKETS
HANDLED SOCKETS
DRILL DRIFTS
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SPECIAL TOOLS

"WONDER" QUICK CHANGE DRILL CHUCK

YOUR JOBBER HANDLES COLLIS QUALITY TOOLS

THE COLLIS COMPANY

CLINTON *Manufacturers* IOWA

Could you Better these Chips with a Solid Tool?

LOVEJOY

Inserted Cutter Tools

The serrations on the cutter mesh with those on the cross piece of the holder and are locked in place by the tapered plug on top. The cutter can't slip in the holder, it won't break at the clamping point.

Accurately and easily adjusted and locked, positively rigid, Lovejoy Cutting Tools give the same efficient service as the highest grade solid tools.

The best proof is in the work. Try them. Detailed description in the circular. Send for it.

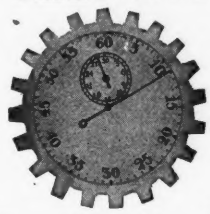
The Lovejoy Tool Company, Inc.

Metal Cutting Tools

SPRINGFIELD VERMONT

Showing the Lovejoy Inserted Cutter Tool in Action.

PHILADELPHIA
GEAR TIME



"Every Second Counts"

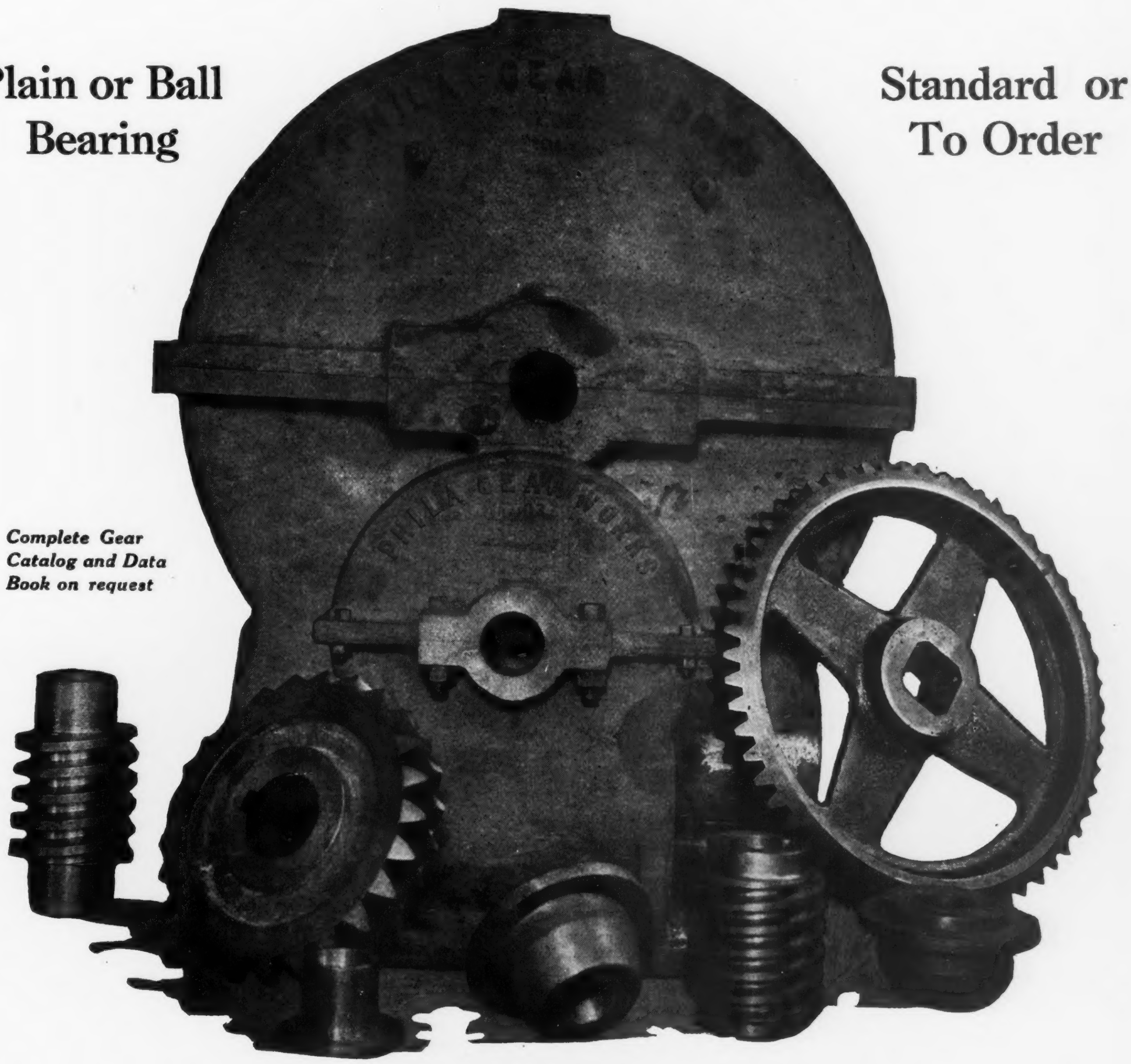
Philadelphia Worm Gear Units

For the convenience of our customers and in accordance with our policy of giving complete gear service our worm and wheel division carries a large stock of standard gear reductions—completely housed, assembled and tested, ready to set up.

Worms are located above or below the gears according to the class of service for which they are designed; centers are accurately fixed beyond possibility of gears getting out of alignment and ample lubrication is provided.

Plain or Ball Bearing

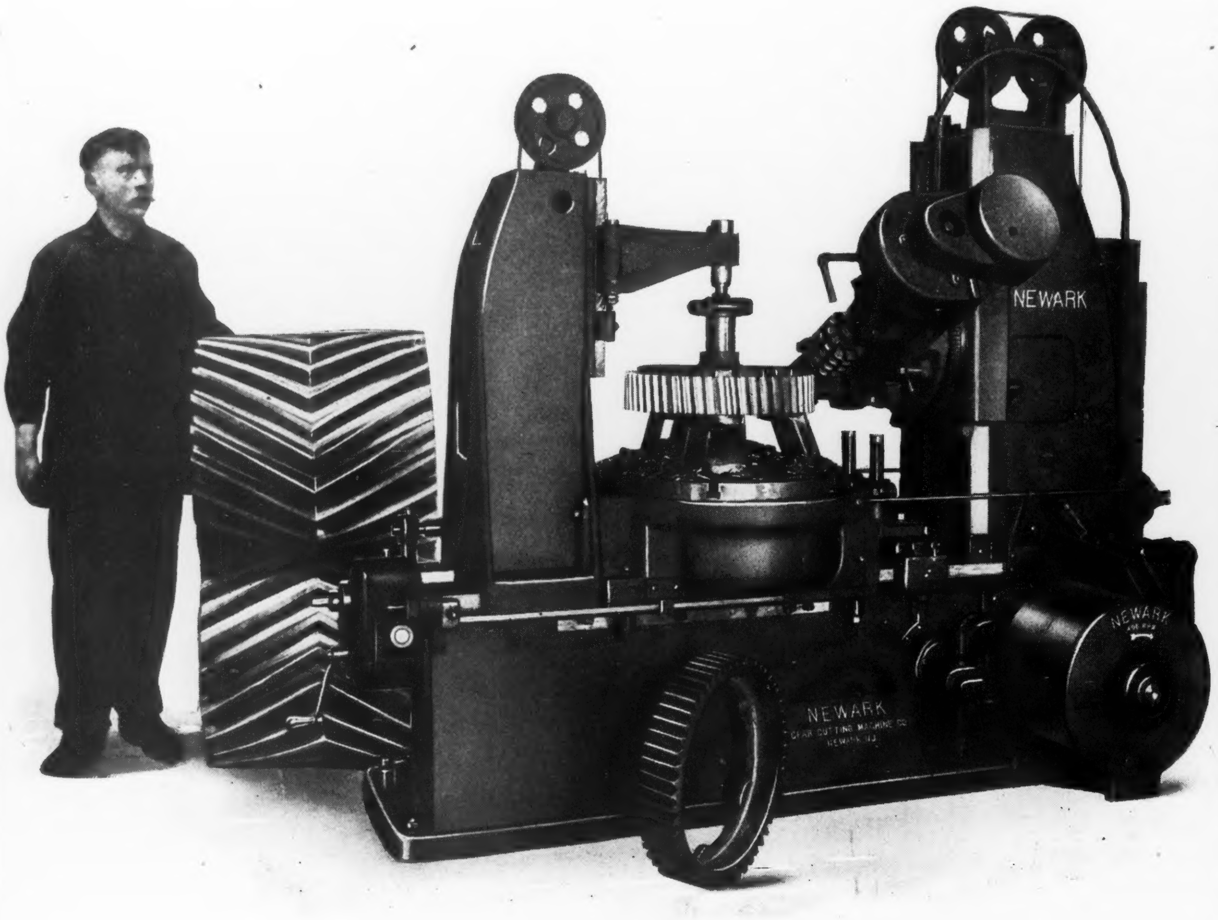
Standard or To Order

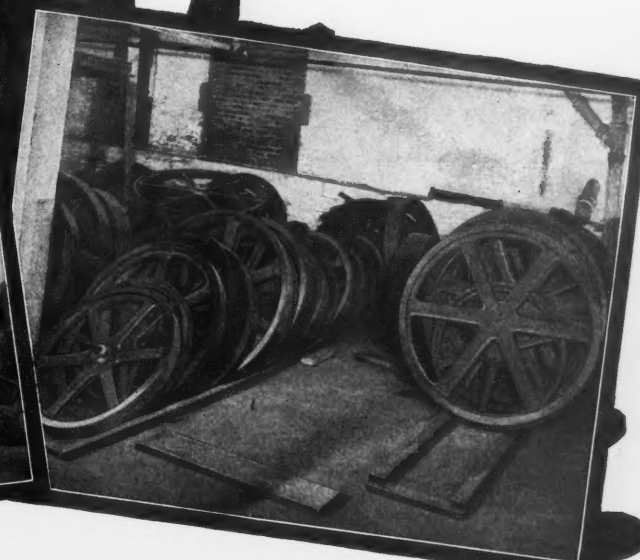


Complete Gear Catalog and Data Book on request

Philadelphia GEAR Works

1120-1128 Vine St.
Philadelphia


NEWARK



Thousands of Gear Patterns

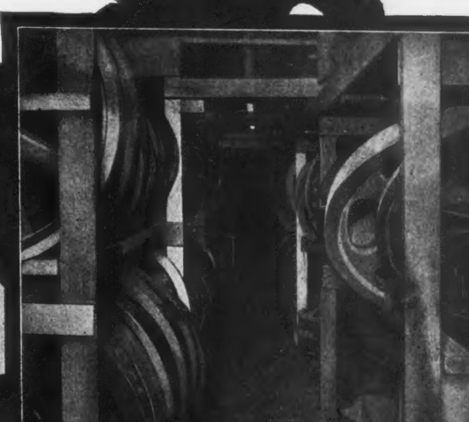
We have a pattern on hand for every gear that our 30-year experience has taught us is liable to be needed in a hurry. You can see, therefore, that you're pretty safe in depending on Meachem Gear Service whenever you're up against it for a quick gear replacement.

But the best way to make sure is to try us now. Just select a few of the gears you're liable to need, and send us the list, telling us you need them in a hurry. We'll surprise you not only on deliveries, but on prices as well, and you'll find that Meachem Gear quality will help to make future replacements less frequent.

THE MEACHEM GEAR CORPORATION

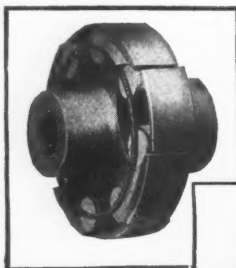
Sole manufacturers of new process Rawhide Gears and Pinions—Still made under the direction of the inventors and the men responsible for every stage in their development.

Canal St. and West Shore R. R.
SYRACUSE, N. Y.



MEACHEM GEARS

Lengthen the Life of Machinery



Type A—Coupling

Type B—Coupling

Type C—Coupling

In a rigidly connected driving and driven unit, the life of the equipment is directly proportional to the vibration and peak load.

Flexible couplings absorb vibration and peak load shocks, thus greatly increasing the life of the equipment.

Nuttall flexible couplings are built in three distinct types—A, B, and C, in order that every particular service condition may be exactly met.

Write for Catalogue No. 15.

R.D.NUTTALL COMPANY
PITTSBURGH AGMA PENNSYLVANIA

Nuttall

HINDLEY GEARS

For Use Where Only the Strongest are Successful

High speeds and hard pulls generally mean Hindley Gears. Accurate, powerful, correctly cut; they meet the stress of strenuous service in many varying mechanisms. Write for figures in connection with applying Hindley Gears to your product.

HINDLEY GEAR COMPANY
1105 Frankford Ave. Philadelphia, Pa.

THOROFINE GEARS **Are Gears of Exceptional Accuracy.**
LARGE GEARS Made with the same care that has given Thorofine small gears their unusual reputation. Our quotations will interest you. Write today.
Merkle-Korff Gear Co.
Formerly Modern Tool & Stamping Co.
313 So. Clinton St. Chicago, Ill.

Hindley Worm Gearing

Complete drives with housing ready for power

ALBRO-CLEM ELEVATOR COMPANY
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BEVEL GEAR GENERATORS.
BEVEL GEARS
CUT THEORETICALLY CORRECT.
Special facilities for cutting Worm, Helical, Miter, Internal and Elliptical Gear Wheels.
The Bilgram Machine Works
1231 Spring Garden Street, Philadelphia, Pa.

Rawhide Gears

Ship Parcel Post

Rush!

Two day delivery plus Parcel Post makes you our next door neighbor.

Specify number of teeth, pitch or outside diameter, face overall, bore and keyseat.

Thirty years' experience enables us to return the highest grade rawhide pinions to you in a minimum time and at a minimum cost.

A trial order will convince you. Our service and prices are pleasing the most discriminating buyers. May we hear from you?

We also manufacture metal gears ¾ inch to 12 feet.

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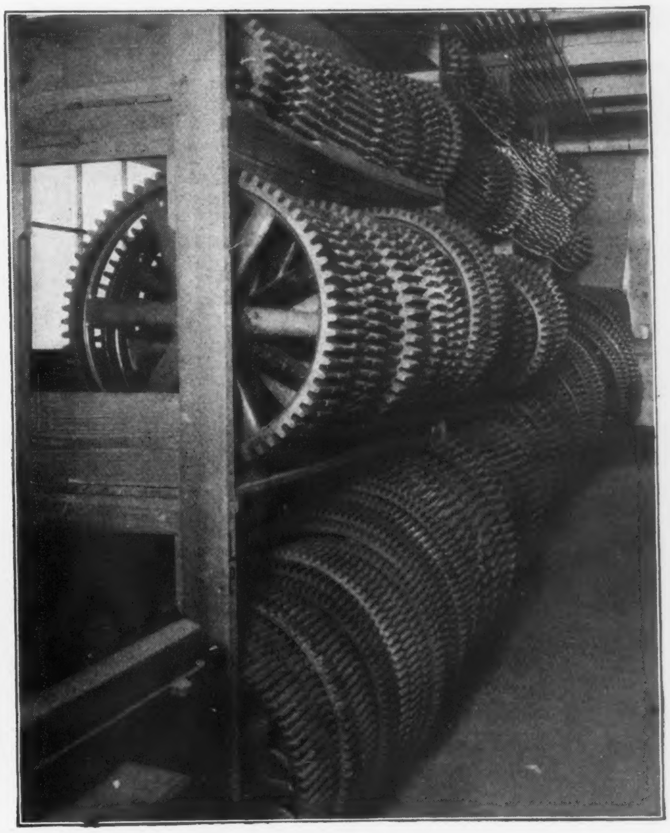
THE HORSBURGH & SCOTT COMPANY

Cleveland, Ohio, U. S. A.



EIGHT out of EVERY TEN

orders that we get for gears come from concerns that have patronized Jones before.

From this it is obvious that Jones has something more to offer than merely *gears*—for many of these orders come from points which are many miles away.

That something is *Service.*

Here, for instance, is a corner of the pattern department. There are row upon row of patterns of standard gears which are indexed to facilitate quick handling.

So, when an order for standard cast-tooth gears comes in, there is rarely any delay on account of patterns.

In many instances the order is completed and the gears are shipped within twenty-four hours.

W. A. Jones Foundry & Machine Co.

4409 West Roosevelt Road, Chicago
20 Murray Street, New York

Jones
Cut and Cast GEARS

MEMBER OF AGMA

J-131

FOOTE
DEPENDABLE GEARS Give Positive Satisfaction

Made of highest quality close-grained metal, and with sufficient metal at every part to give a wide margin of safety, yet without excess weight—made accurate and true and rigidly inspected. FOOTE GEARS give positive satisfaction.

Submit your gear problems to Foote. Foote Engineers are at your service to assist you with your gearing problems.

Foote Bros. Gear and Machine Company

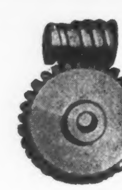
Manufacturers of Rawhide and Bakelite Pinions and Cut Gears of All Kinds

Send for Catalog.

242-252 N. Curtis St., Chicago, U. S. A.

FOOTE DEPENDABLE GEARS

Meisel Gears



Quality Assumes All Obligations

Quality delivers the only reliable service. Quality, providing it is uniform, settles the question of continued dependability. Quality in the final reckoning brings cost to the most economical figures.

Meisel quality is quality without compromise, the product of steadfast purpose to maintain a standard that cannot be surpassed.

MP Registered

Making gears to this formula has made our business one of the most important factors in industry. Let us show how profitably we can serve you in the gear field.

We also take Screw Machine Work up to 5½" and do Heat-treating, Broaching, Contract Work, Case Hardening, Tooth Rounding, Splining and Internal and External Grinding.

MEMBER OF AGMA

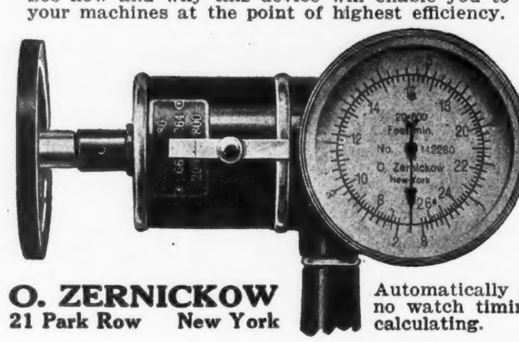
Meisel Press Mfg. Company

948 Dorchester Ave., Boston 25, Mass.

Get a Descriptive Circular of the

O-Z CUTMETER

See how and why this device will enable you to operate your machines at the point of highest efficiency.



O. ZERNICKOW
21 Park Row New York

Automatically correct, no watch timing or calculating.

SPUR—BEVEL—SPIRAL—WORM

GEARS

Automobile Gears in Large Quantities

TAYLOR MACHINE COMPANY

7804 CARNEGIE AVENUE CLEVELAND, OHIO

HERRINGBONE CUT GEARS

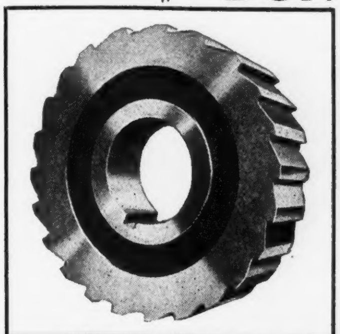
MILL DRIVES
SPEED REDUCERS

SPUR
WORM
BEVEL GEARS

FAWCUS MACHINE CO. PITTSBURGH, PA.

DON'T BUY NEW MILLING CUTTERS

Until We Have Reclaimed Your Old Ones



Useless Wornout Cutter

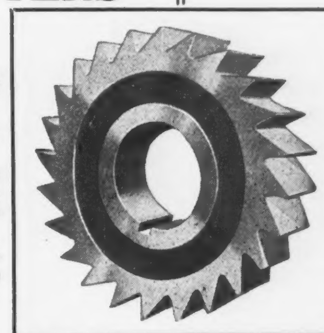
Your worthless wornout Milling Cutters, Reamers, Slitting Saws and End Mills can be **made as good as new** at a fraction of their original cost by the "Eastern Cutter Salvage Process."

Most important of all WE DO NOT ANNEAL the tool or disturb the original temper.

The largest national manufacturers are having their tools "Eastern" salvaged—Westinghouse and General Electric for instance. Can you afford not to investigate this most genuine money-saving proposition?

Here is an example—*A HSS Plain Milling Cutter 3" x 3" costs approximately $20.00 today. We reclaim this tool when worn out for $4.48, and make it as good as when new.*

Write for latest revised price list or send orders direct to



Same cutter "Eastern" Salvaged

Eastern Cutter Salvage Corp., 115 Kirk Place, Newark, N. J.

New England Representative:—E. C. Van Sickel, 28 School St., Boston, Mass.

Save High Speed Steel

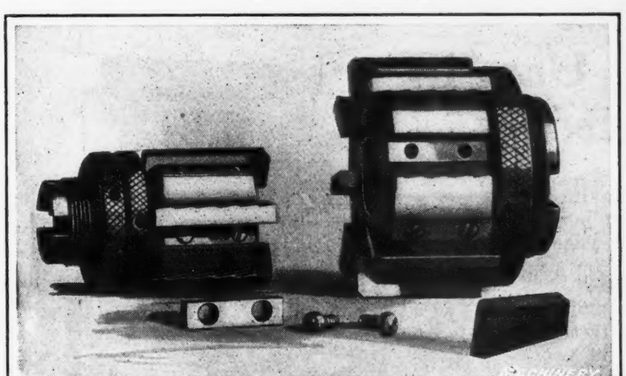
Corresponding corrugations on the blades and gripping parts make it possible to get accurate adjustment and make slipping impossible no matter how short the blades.

Made also with spiral set blades and in special styles to suit requirements.

Adjustable Reamers
(design patented)
in which the blades *cannot* slip

THE CLEVELAND CUTTER AND REAMER COMPANY CLEVELAND OHIO

Send for Circular



The Cleveland Cutter & Reamer Co.
1619 Merwin Avenue CLEVELAND, OHIO
Detroit Office: 2180 East Grand Boulevard

COWLES CUTTERS

FOR DEPENDABILITY

Quality First

Plain Milling Cutters	Concave Cutters
Side Milling Cutters	Shell End Mills
Interlocking Side Milling Cutters	Metal Slitting Saws
End Mills	Gear Cutters
Angular Cutters	Inserted Blade Cutters, etc.
Convex Cutters	Special Cutters

They are producers, tempered to *Red Hardness*, making them *Tough* and *Durable*.

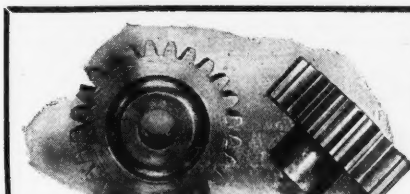
We carry a large stock. Wire or mail inquiries.

We sell DIRECT to the USER

COWLES TOOL COMPANY
CLEVELAND OHIO, U. S. A.
Cutter Designers and Manufacturers

Overland Model Four Timing Gears In Stock

CLOYES GEAR WORKS
1620 Collamer Avenue Cleveland, Ohio



Gears and Gear Cutting

We guarantee satisfaction

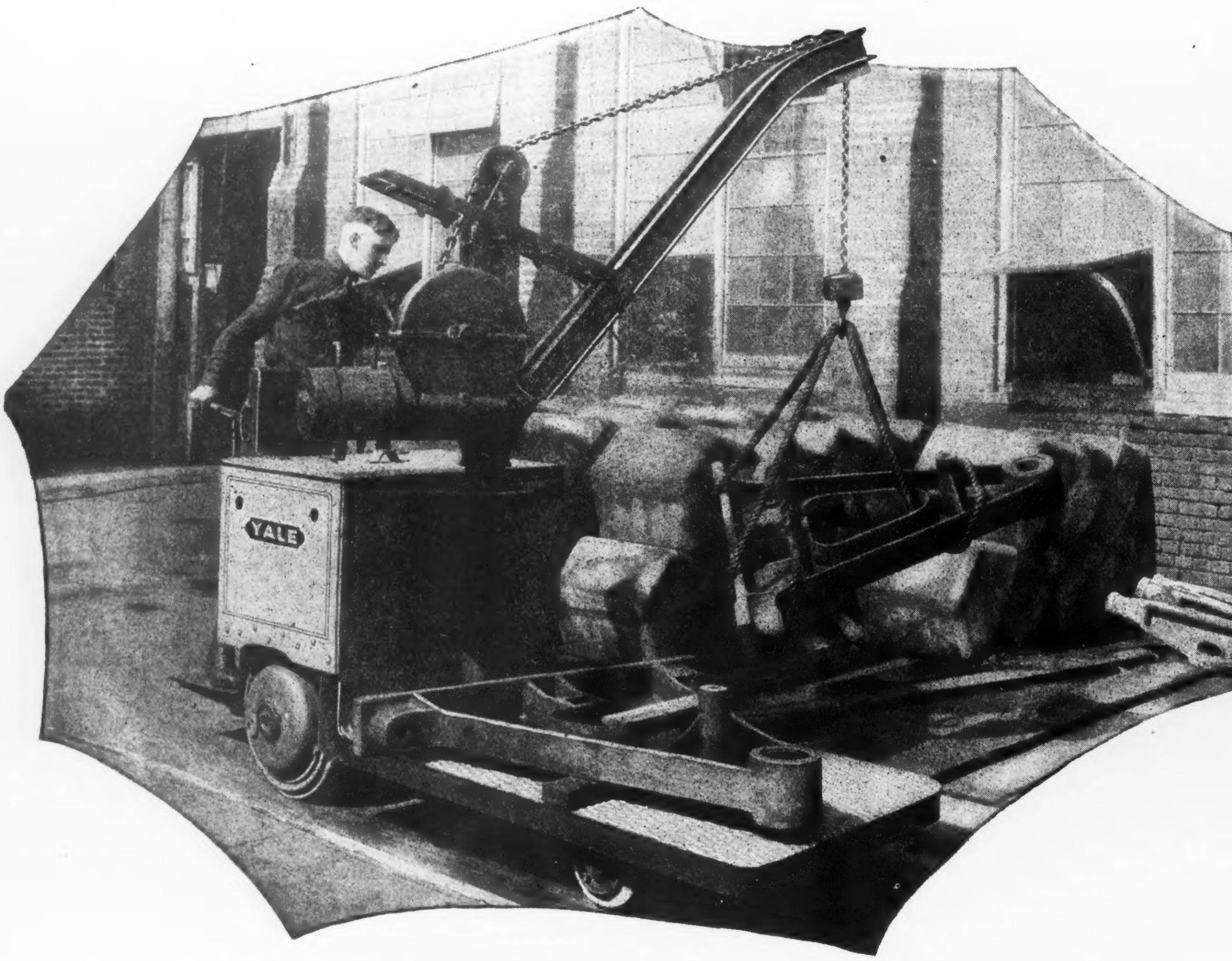
RODNEY DAVIS
PHILADELPHIA, PA.

You've Heard of the Red-E Dog and Driver for Milling Machines

It's a time and money saver. No spoiled work due to incorrect spacing and dog working loose. Just what you want for milling spirals and tapers or cutting gears.

Write for Catalog 19-M for details of all our tools.

Mayhew Steel Products, Inc.
Ready Tool Co. Division
291 Broadway
NEW YORK N. Y.



The Yale Way is a 1-Man Way

THE Yale DF-60 Crane Truck illustrated, enables one man to carry these heavy shaft hanger brackets from the rough storage yard into the machine shop, and to place them directly on the planer bed.

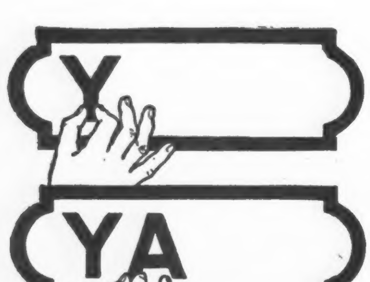
Consider the saving effected by this in both time and labor!

Careful studies recently made in a large manufacturing plant showed that each ton of finished products turned out required the equivalent of 268 tons of handling.

The Yale Way more than pays for itself the first year in the saving it effects in material handling costs.

We can tell you, for instance, how one Yale truck saved $60 per day hauling foundry sand; how in another plant a return of 344% on the investment was effected the first year; and numerous other instances of unusual savings.

Write today for facts about Yale Electric Industrial Trucks, Tractors and Trailers, Chain Blocks, Electric Hoists, and Trolley Systems.



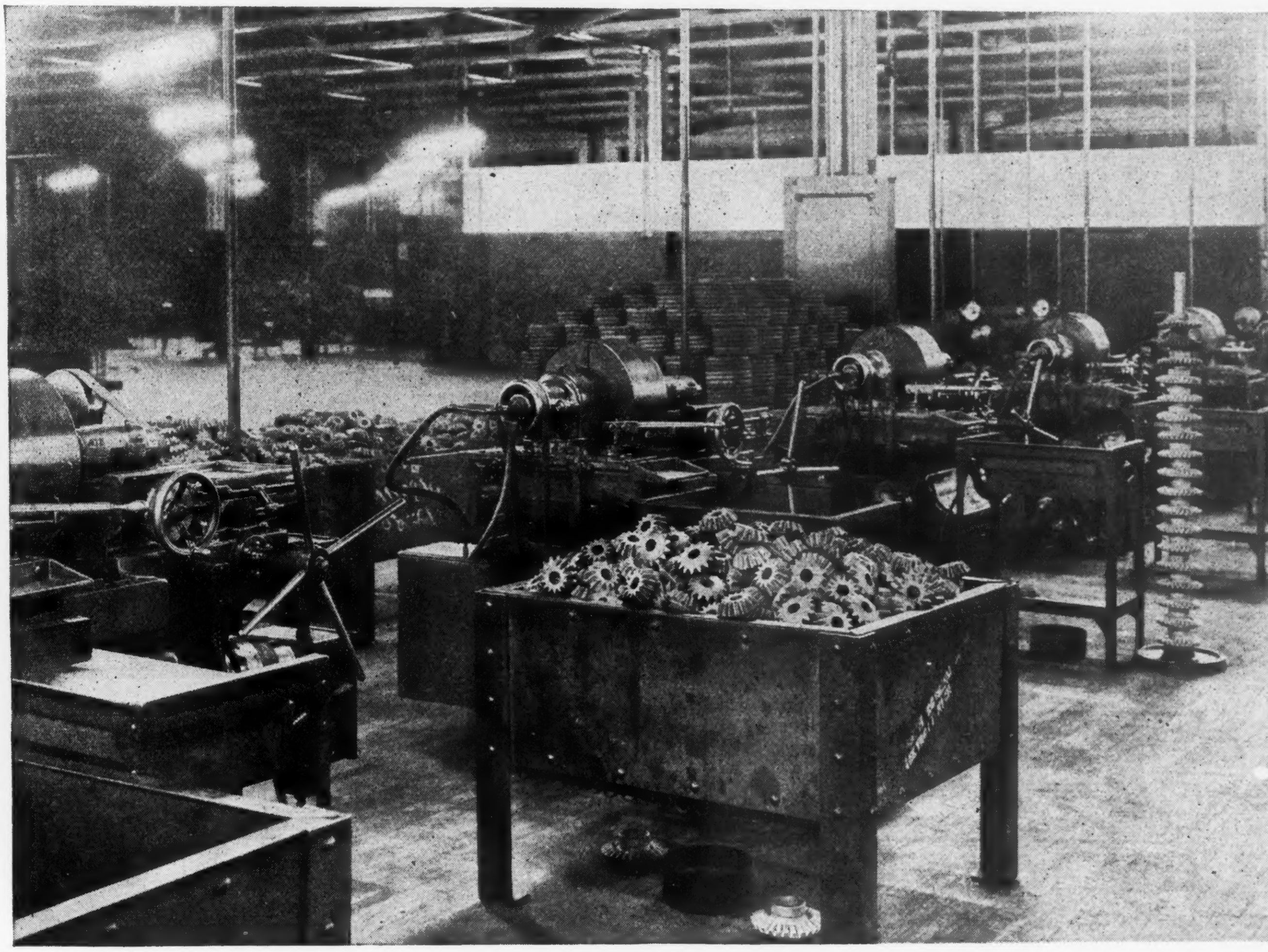
Yale Made is Yale Marked

The Yale & Towne Mfg. Co.

Makers of Yale Products: Locks, Hoists and Electric Industrial Trucks

Stamford, Conn.

TRADE YALE MARK **Hoisting and Conveying Systems**



An example of the thorough, yet shadowless illumination afforded by Cooper Hewitt lighting

Why They Decided on Cooper Hewitt Lighting

"It may interest you to know why I called up and gave you my decision. I was over the other night and looked at the lighting in the plant you recommended. When I went in I noticed all lighting was at least 35 feet above the work and no drop lamps on the machines anywhere I thought the men must be having a hard time to get by with that condition, but when I inspected the working point, I was surprised to note that there was practically a daylight condition there.

"I asked the mechanic if he could see his work all right with his light so far away, and he told me that it was all right; that he would 'just as well work under that light as daylight.' I asked three or four others and received the same opinion. I even did a short trick on one or two machines to thoroughly convince myself and then I asked the foreman.

"He told me that their night production was kept up to the day standard, and had been for a long time; that he considered the men had as good light conditions as the day shift.

"Right then I recalled that another firm in this city who had been doing similar work on similar hours, and whose plant was incandescent lighted, had been but 75% efficient at night as compared with the day.

"That is why I decided to install Cooper Hewitt Lamps, and that is why you had a telephone call to come down and get the order."

Isn't this a good enough reason for lighting *your* factory with Cooper Hewitts?

Cooper Hewitt Electric Company

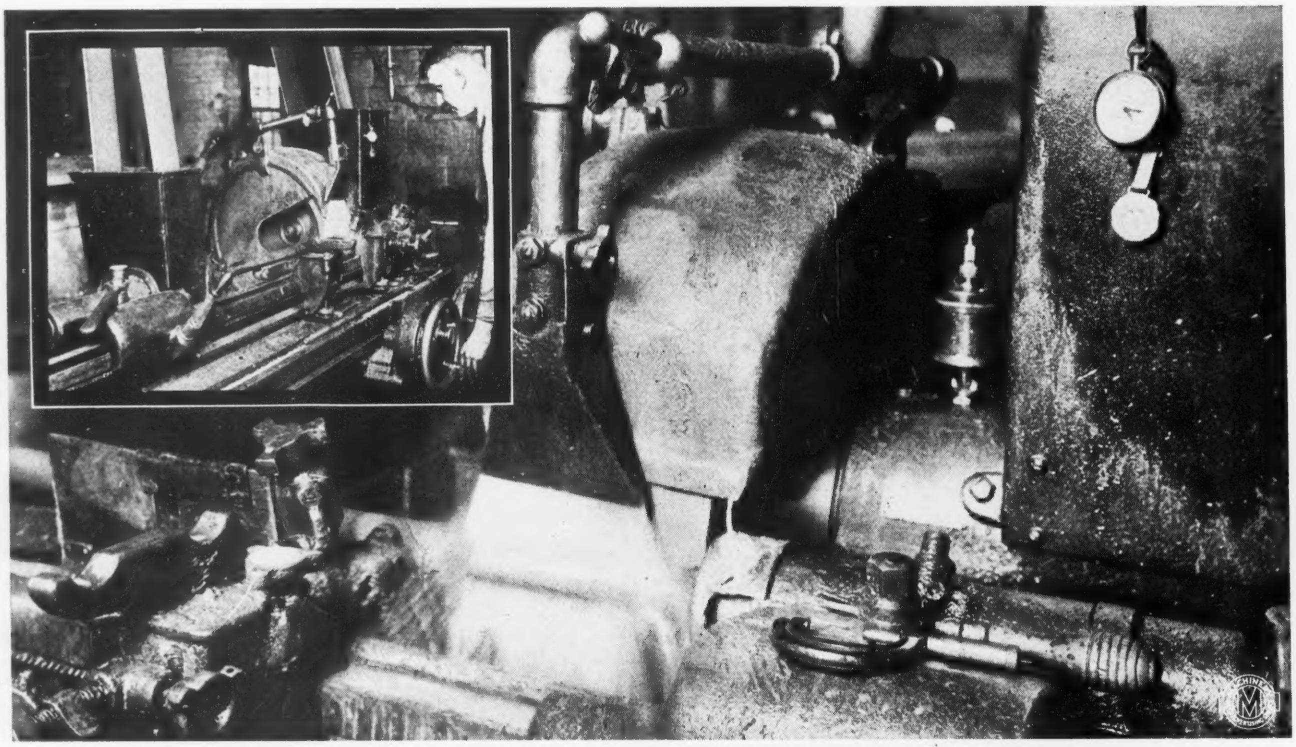
Hoboken **New Jersey**

BETTER THAN COOPER HEWITT LIGHT INCREASES PRODUCTION DAYLIGHT

Boston—161 Summer Street
Chicago—618-9 Fisher Building
Cincinnati—First National Bank Bldg.
Cleveland—Engineers' Building
Detroit—Ford Building
Hoboken—95 River Street

Los Angeles—Keese Engineering Corp.
Milwaukee—Security Building
New York—120 Broadway
Philadelphia—Drexel Building
Pittsburgh—Westinghouse Building
St. Louis—Title Guaranty Bldg.
Syracuse—University Building

CH-66



ECONOMY

TRADE MARK REG. U.S. PAT. OFF.

EC OMY

GRINDING LUBRICANT

Saves Power
Speeds Production
Satisfies the Operators

Economy Grinding Lubricant Speeds the Production of Automobile Axle Shafts in the Plant of the Edwards Electric Company, Easton, Pa.

Once again the three dominant characteristics of Economy Grinding Lubricant come to the fore: saving power, speeding production and satisfying the operators.

So far-reaching are the benefits of Economy Grinding Lubricant in wet grinding that once tried it is always used by plants employing this process.

There's the freedom from clogging, the free cutting, the absence of rust, the finer finish. You realize the cutting qualities of your wheels are being utilized to the utmost.

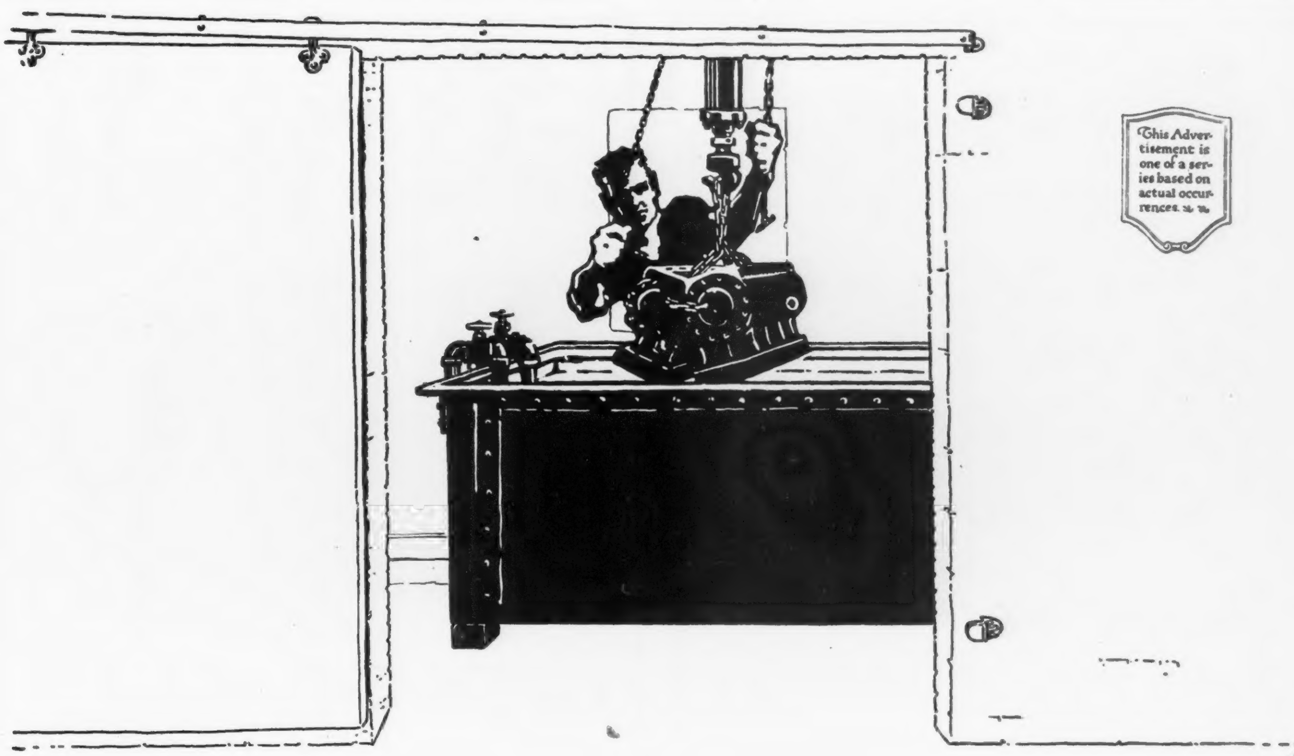
Then, think of the men—no more burnt hands and faces from alkaline solutions—no objectionable odor.

All along the line Economy Grinding Lubricant will be a distinct benefit to your plant.

Send for sample and quotations

THE WHITE & BAGLEY COMPANY

Worcester, Mass., U. S. A.



Saves $180 Weekly Since Cleaning Auto Parts With OAKITE

An Auto Factory now uses Oakite materials instead of caustic soda for cleaning fenders, dash plates and other sheet steel parts, because Oakite saves at least $180 every week in labor, and does faster and better work.

Formerly had trouble with rejects after japanning—which ran 6% to 8%, sometimes as high as 15%. Parts are now so thoroughly cleaned that japan takes perfectly and rejects are unknown.

With caustic it was necessary to wipe parts with gasoline before tack ragging. The elimination of this step, together with the fact that parts cleaned with Oakite are easier to wipe than parts cleaned with caustic, has made it possible for two men to do as much work as eight men did under previous conditions.

Write for booklet—Oakite Service for Automobile and Aeroplane Manufacturers. Sent free on request to responsible concerns.

OAKITE MANUFACTURED BY OAKLEY CHEMICAL CO. 26 THAMES STREET · NEW YORK

The Sign of Efficiency — The Sign of Durability

MORSE DRIVES

SILENT CHAIN — THE MORSE "ROCKER JOINT"

Positive as Gears — Flexible as a Belt — Longer Life

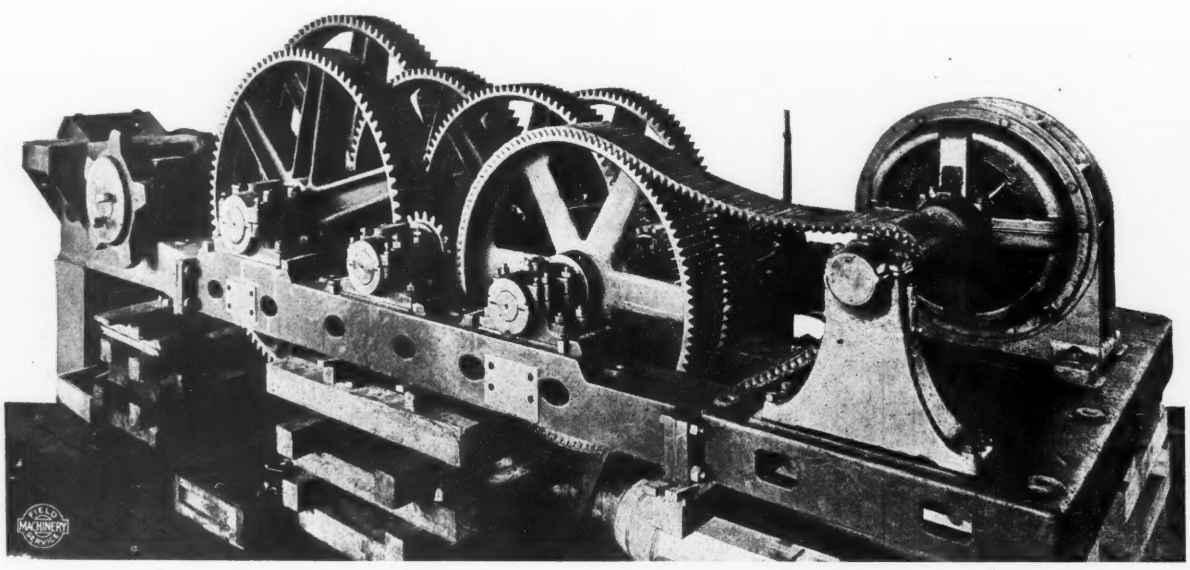
Extensively Used for Special Mill Machinery

The Vaughn Machinery Company of Cuyahoga Falls, Ohio, has been using Morse Chain Drives for the past ten years, in equipping its well-known line of steel and rubber mill machinery—principally on draw benches, wire drawing frames, pointers and calenders.

The Morse Chain shown is used to transmit power from a 17 tooth gear on a 100 H.P. motor, to a 113 tooth drive sprocket on the reduction gearing of a Vaughn Straightway 4″ Draw Bench—a distance of 60″ between centers.

Morse Drives run cool, oil baths not required, save power and space, increase production, allow better arrangement and reduce maintenance costs. Our engineers are ready to show you.

See our exhibit at the Seventh National Exposition of Chemical Industries, 8th Coast Artillery Armory, New York, week of September 12.



MORSE CHAIN CO., LARGEST MANUFACTURERS OF SILENT CHAINS IN THE WORLD **ITHACA, N. Y.**

Morse Engineering Service — *Assistance Without Obligation*

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KANSAS CITY, MO., Finance Bldg. .... Morse Engr. Co.
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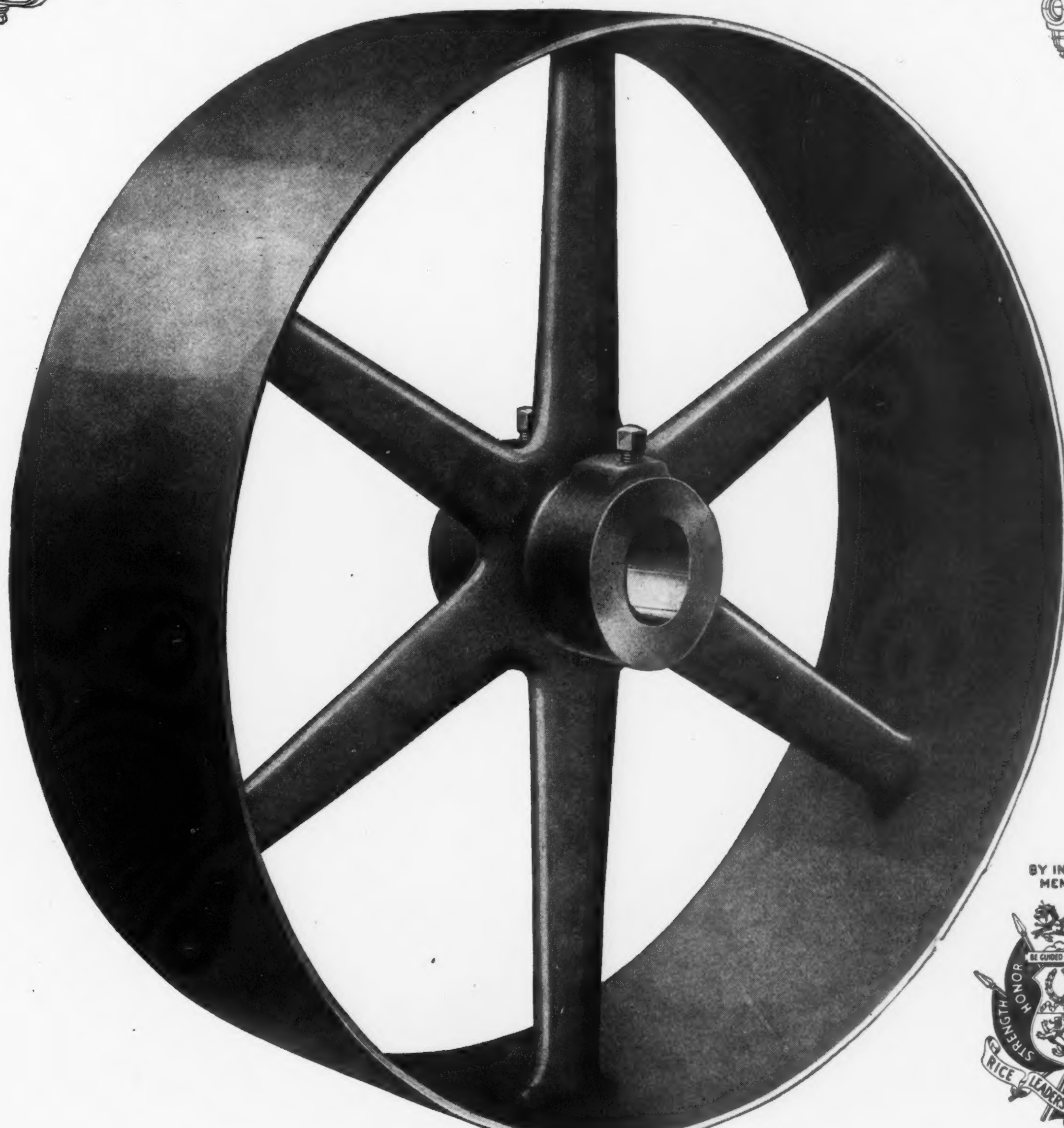
"Morse" is the Guarantee Always Behind the Efficiency, Durability and Service



BY INVITATION MEMBER OF

STRENGTH HONOR QUALITY SERVICE

RICE LEADERS OF THE WORLD ASSOCIATION

NEW YORK, U.S.A.

In the Final Analysis——Cast-Iron Pulleys

Have you ever thought of the pulley troubles you have had and how invariably the drive was made satisfactory by installing Cast-Iron pulleys—either supplanting pulleys of some other type or by changing to cast-iron pulleys of suitable construction?

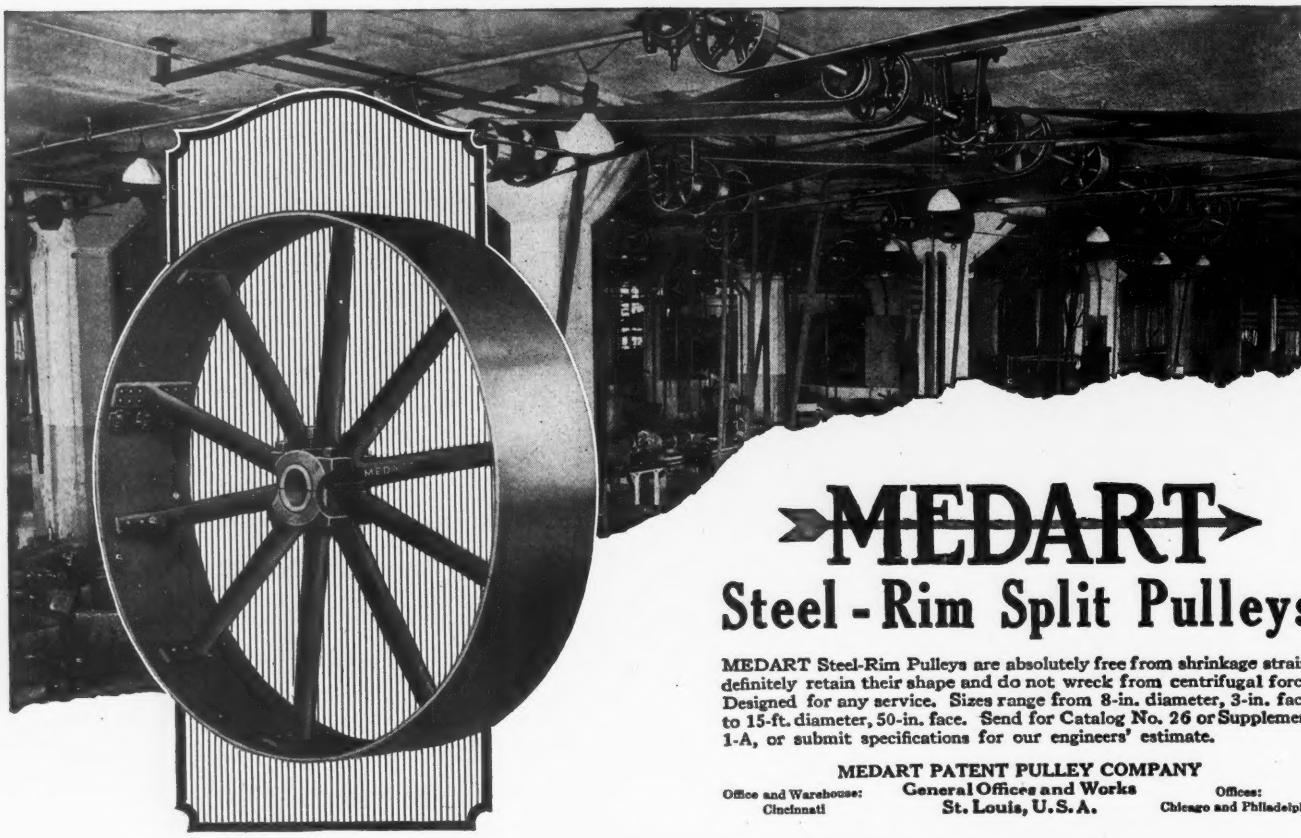
BUT IT WAS A CAST-IRON PULLEY THAT FINALLY STOOD UP UNDER THE SERVICE

Almost every user of power has had this experience and always the solution of continuously satisfactory transmission service has been the installation of cast-iron pulleys.

The use of cast-iron pulleys in the initial installation will prevent trouble.

T. B. WOOD'S SONS CO., Chambersburg, Penna.

POWER TRANSMITTING MACHINERY



MEDART

Steel-Rim Split Pulleys

MEDART Steel-Rim Pulleys are absolutely free from shrinkage strain, definitely retain their shape and do not wreck from centrifugal force. Designed for any service. Sizes range from 8-in. diameter, 3-in. face, to 15-ft. diameter, 50-in. face. Send for Catalog No. 26 or Supplement 1-A, or submit specifications for our engineers' estimate.

MEDART PATENT PULLEY COMPANY

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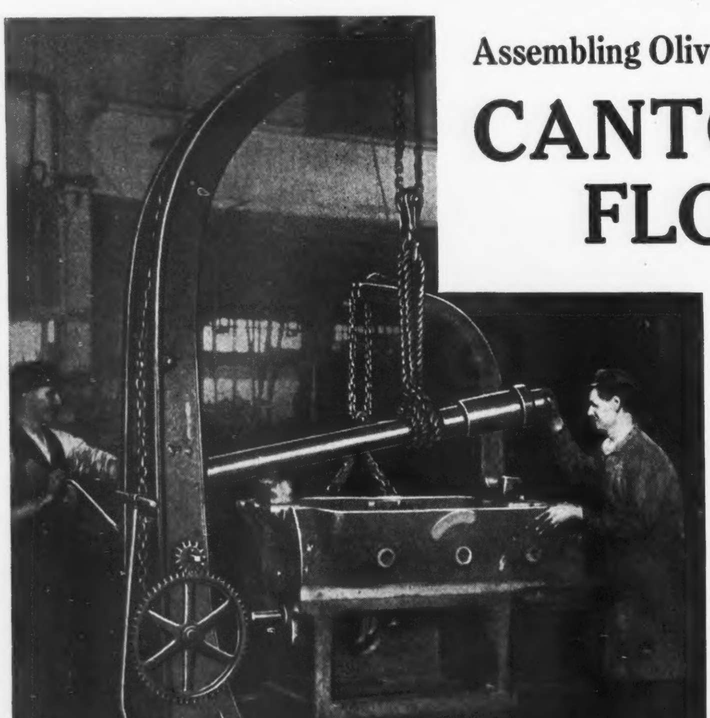
MEDART *means* **EVERYTHING** *in* **LINE SHAFTING EQUIPMENT**



Assembling Oliver Lathes is Vastly Simplified by the Use of

CANTON PORTABLE FLOOR CRANES

They're "The Handiest Tools in the Shop," say the men at the Grand Rapids, Michigan, plant of the Oliver Machinery Company, where this photograph was taken.

They do the work of the overhead cranes when these are busy or have a "break down"; run with ease into the corners where trolleys do not carry, under galleries and close up to machines that overhead cranes cannot reach.

Especially valuable in the Lathe Department where their use facilitates assembling—cuts labor costs—and reduces the danger to heavy parts.

Sizes to carry loads up to 6000 pounds, one man operation. Catalog?

CANTON FOUNDRY & MACHINE COMPANY, Canton, Ohio

Permanent Exhibit Salesroom, 45 West 18th St., New York

SUCCESS

Success in manufacturing is dependent upon many factors, but since selling prices are largely determined by market conditions, it hinges primarily on obtaining the lowest possible factory cost.

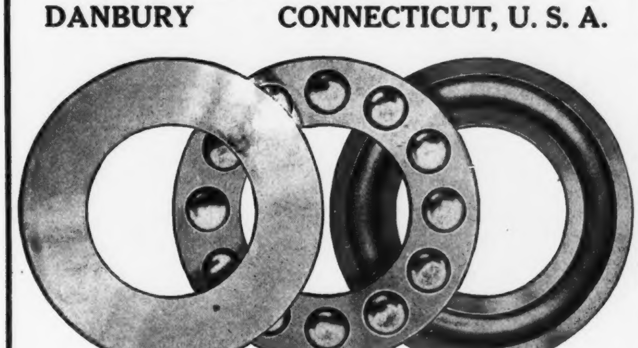
Investigation shows that power wastage and repairs to bearings are among the largest losses a plant can sustain. By choosing Ball and Roller Bearings both these leakages can be brought to the irreducible minimum.

Ball and Roller Bearings

We make Radial Roller Bearings, Journal Roller Bearings, Roller Thrust Bearings and Ball End Thrust Bearings (in both inch and millimeter sizes). We carry a full line and have unusual facilities for manufacturing Cylindrical Rollers.

Catalog 9 yours for the asking

THE BALL & ROLLER BEARING COMPANY
DANBURY CONNECTICUT, U. S. A.



AMERICAN STEEL SPLIT PULLEYS

More than five million "American" Pulleys now save power in efficient shops here and abroad.

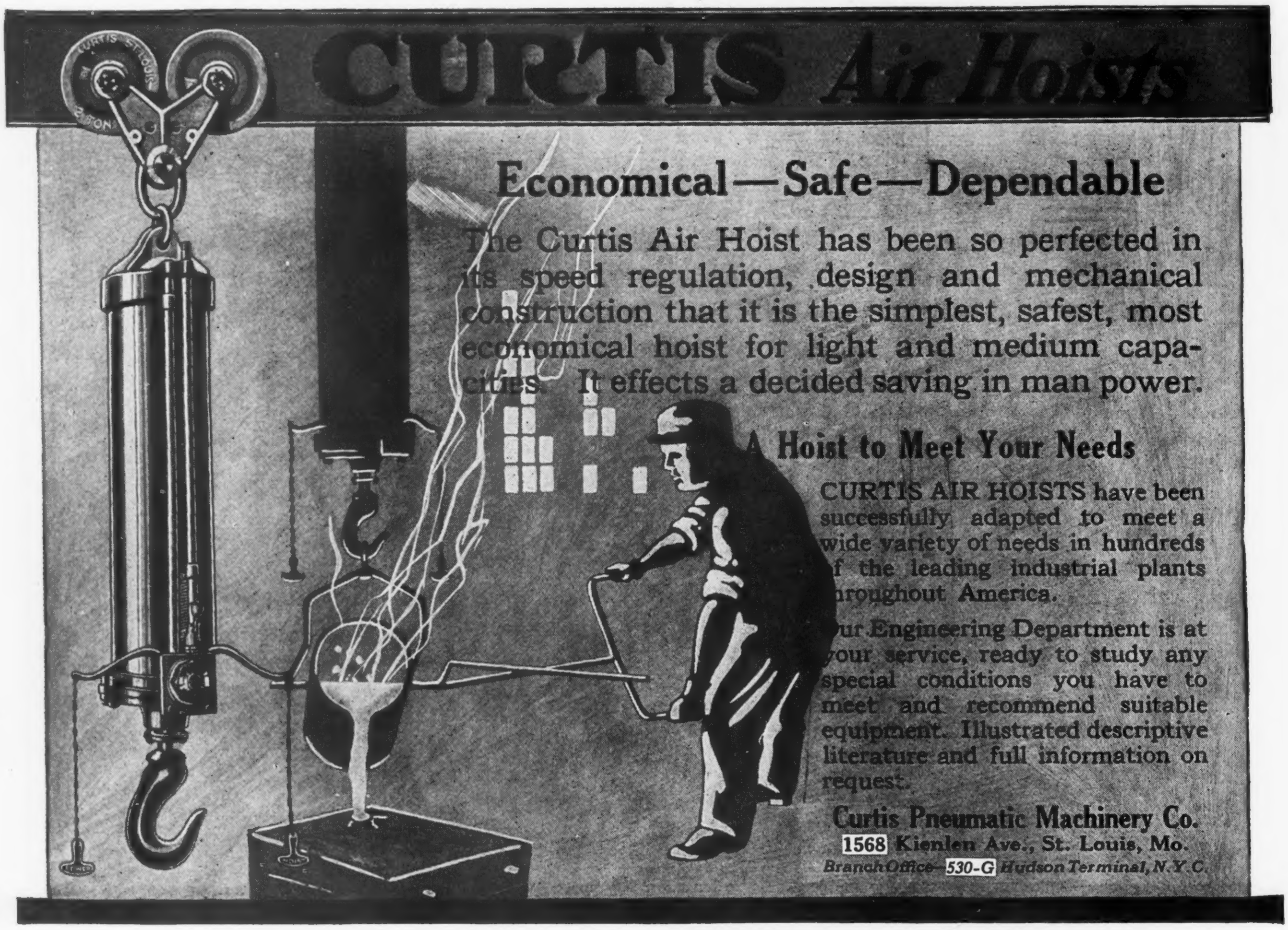
Basic Principles that Stand New Tests

SUCH features as strength, durability, weight, power conservation and ease of application of various types of pulleys were tested and studied in designing the "American" Pulley. Though there have been refinements, it is significant that the basic design has met every new test.

Send for booklet, "Getting Maximum Pulley Efficiency," which shows commonly unknown pulley facts.

The American Pulley Company
Philadelphia, Pa.

The AMERICAN PULLEY

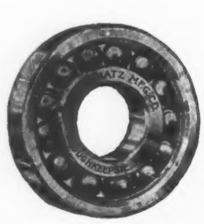


THE
"Commercial"
ANNULAR BALL BEARING

A large fraction of all Commercial Annular Ball Bearings have special features and are designed to cheapen or simplify the customer's assembly. Problems in annular ball bearings should be referred to us for the most economical solution.

Inexpensive. For moderate radial and radial-thrust loads at 3000 r.p.m. or less.

Send for catalog, discount sheet and samples.



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Poughkeepsie, N. Y.
Pacific Coast—F. M. Cobbledick Co., 1031 Polk Street
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CRESSON-MORRIS CO.

Power Transmitting Machinery

We make a specialty of equipping plants completely with power transmission machinery; including shafting, rope-transmission, machine cut and molded iron and steel gears for heavy service.

Almost sixty years' experience and competent engineering advice are at your disposal.

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Engineers—Founders—Machinists
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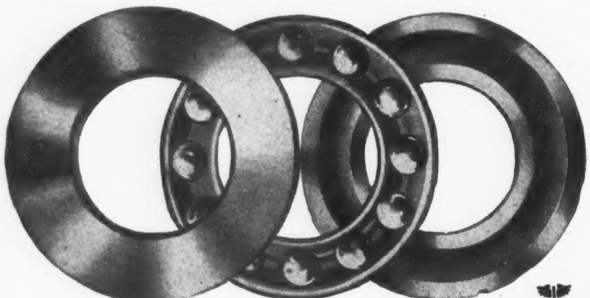
Branch Office: 141 Milk Street, Boston, Mass.

THE BEARINGS COMPANY OF AMERICA



Manufacturers of

Thrust Ball Bearings
of all types

Let our engineers help to solve
your Thrust Bearing problems

Drop Forgings **"Star" Ball Retainers**

The Bearings Company of America
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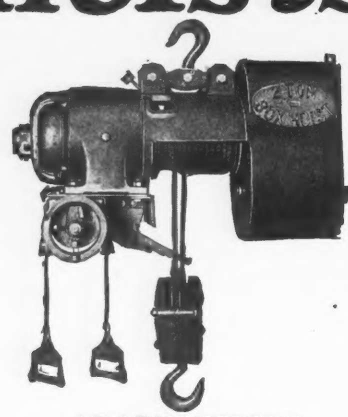
DETROIT, MICH., OFFICE: 1012 Ford Bldg.

Electric Hoists



ADAPTABILITY

Machines for every purpose where loads must be quickly lifted. Manufactured in standard sizes. Immediate shipment on those for regular voltages.

Write for Bulletin No. 2600 and benefit by our 41 year's experience.

ESTABLISHED 1878

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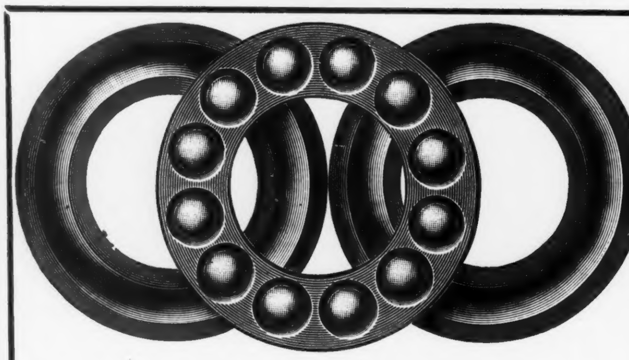
ALFRED BOX & COMPANY, INC. PHILA. PA.



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Reflect the perfection of a life-long study of bearing construction.

Workmanship of the highest standard.

Designing of scientific engineers.

And the highest degree of perfection.

Bearings Made to your Requirements

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DUCKWORTH CHAINS and SPROCKETS

ROLLER TYPE

½", ⅝", ¾", 1" Pitch. All Standard Widths

BLOCK AND TWIN ROLLER TYPE

1" Pitch ⅛", 3/16", ¼", 5/16", ⅜", ½" Wide.

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The Largest Manufacturers of Motorcycle Chains in the World

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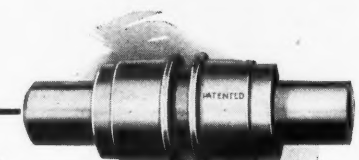

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Hanson Friction Clutch

THE

HANSON

CLUTCH & MACHINERY CO.

TIFFIN, OHIO, U. S. A.

COCHECO BELTING

Have you ever considered the part the belt plays in the work you get from the power you buy? Walk through the shop, examine your belts and note their condition—then see which are those delivering all you pay for.

Cocheco Belting saves power by reducing waste. Cut from backbone center stock of carefully curried oak tanned packer steer hides it is "live" leather—belting that retains its resiliency indefinitely.

We've made belting for 79 years—Cocheco represents the best experience of those years. Let us tell you some of the things we have learned about belting and, incidentally, a little more about Cocheco.

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GIVE ME A TRIAL

the next time you have some lifting to do.

I can be depended upon.

My pedigree will be cheerfully sent you.

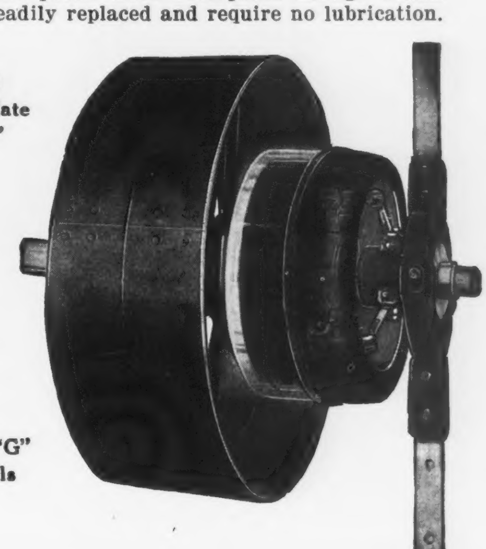
WRIGHT MANUFACTURING COMPANY LISBON . O . U.S.A

"EDGEMONT"

The Clutch for Hard Service

Wherever power transmission is intermittent, the Edgemont Clutch is the ideal method of control. No load too heavy, no speed too high; it is simple, easily adjusted and guaranteed to transmit full rated power; regularly used in many well-known machines and countershafts. Friction plates have burn-proof linings which are readily replaced and require no lubrication.

Extended Sleeve Plate Type "C"



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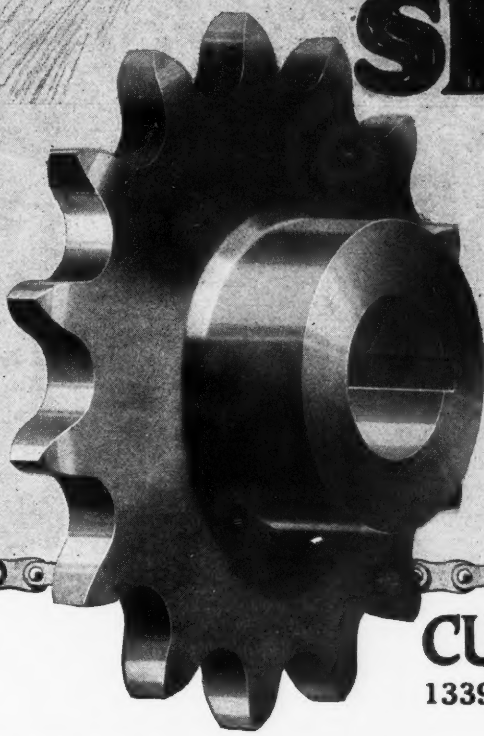
THE EDGEMONT MACHINE CO.
2700 National Ave. DAYTON, OHIO

CULLMAN SPROCKETS



Stock and to Order Diamond, Whitney, Baldwin, Duckworth, and Coventry Chains. Block, Roller and High Speed Silent Types on Hand.

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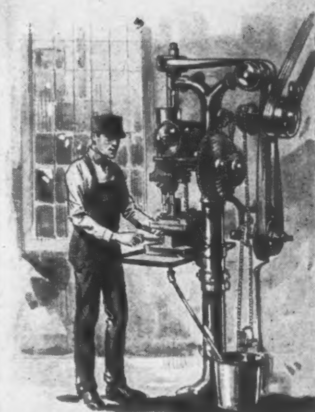
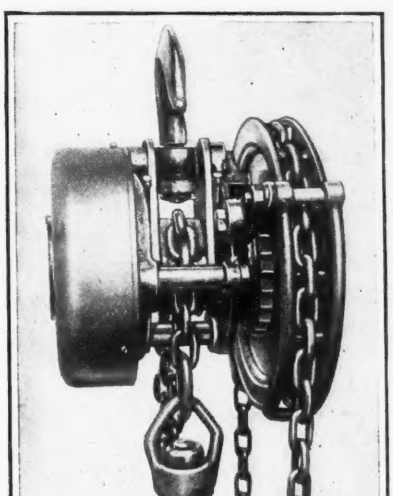


CULLMAN WHEEL COMPANY

1339 Altgeld Street **CHICAGO**

"G. B." SPUR GEARED CHAIN BLOCK



The Load at All Times Is Under Complete Control

A light pull, and up goes the load. Stop pulling, and, without jerking, it becomes instantly motionless. Lowering is under complete control at all speeds.

Blocks are finely finished, and run up to 20 tons rated capacity, each tested to a 50 per cent overload.

Write for full particulars.

ANDRE WEILL & COMPANY, Inc.

149 Broadway **New York, N. Y.**

Exclusive Representatives of Etablissements Beccat, Paris

Peerless Hoists

From Hook→

To

Hook→

100%

Efficiency

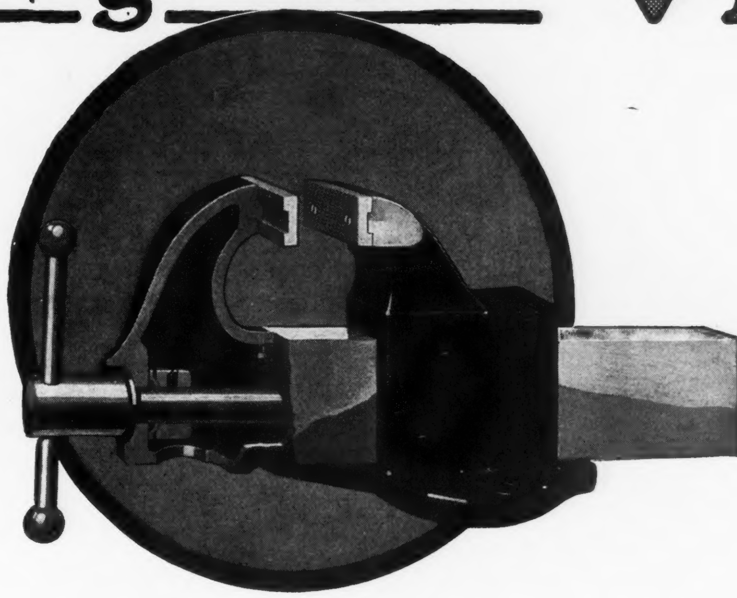
IN

Hoists

Edwin Harrington, Son & Co., Inc.

Philadelphia, Pa.

COLUMBIAN
Sledge-Tested VISES



Twice as Strong as Cast Iron

COLUMBIAN Sledge-Tested Vises are the only vises made of malleable iron and because of this fact, and the patented hollow jaw construction, they are twice as strong as cast iron vises of the same size.

Columbian Vises are better vises also because of their greater depth of jaw, their easier working quality, their removable steel jaw faces and self-aligning screw. The ball ends of the handle are forged on and can never come off.

Columbian Machinists' Vises are standard equipment in the foremost industrial and railroad shops of the United States and Canada and are carried in stock in every industrial center.

Yet these fine vises cost no more than you are asked to pay for cast iron vises.

When you buy vises specify Columbian.

Columbian Hardware Division

of The Consolidated Iron-Steel Manufacturing Co.

World's largest makers of vises and anvils.

Cleveland


FRANKLIN DIE-CASTINGS
Spreading a Great Educational Influence
Not so long ago good music was a treasure of the chosen few. Years of study were necessary to play an instrument. Today, irrespective of technical skill, the great educational influence of good music is at the command of everyone.
Among other modern manufacturing methods the Die-Casting Process has been instrumental in enabling the general public to enjoy good music. Franklin Die-Castings, used in phonographs, player pianos and organs, have helped to reduce production costs in the manufacture of these instruments.
Franklin engineers, in 1892, originated the die-casting process. Franklin Die-Castings have helped manufacturers ever since to speed and simplify production in many fields of industry.
The addition of the standard No. 12 Aluminum to the Tin, Lead and Zinc base alloys already in use enables us to meet a still wider range of individual needs.
We quote from samples or blueprints.
Write for booklet "Franklin Die-Casting in Many Fields."
FRANKLIN DIE-CASTING CORPORATION
Gifford and Magnolia Sts.
SYRACUSE, N. Y.
ERNEST HAMLIN BAKER

"Carefully Forged—
Correctly Heat-Treated"

You can always say it of

Dyson Spindle Forgings

Made to match the quality of the finest machines. Try them.

JOSEPH DYSON & SONS
CLEVELAND OHIO, U. S. A.

How would you produce a part like this?

Our
Experts Proved

ACKLIN STAMPING

The Best and Cheapest Way

This electric fan base, Acklin Stamped and ready for finishing, is an excellent example of the satisfactory results obtained by our methods; the economy of the method can only be realized by comparison of costs.

Let our experts estimate on some part you are now machining—and then make your own comparisons.

The Acklin Stamping Company
1657½ Dorr Street TOLEDO, OHIO

HOYT SOLDERS

Solder users everywhere recognize the high quality of HOYT Solders—the result of perfect mixing and refining of carefully selected metals by the most modern methods. No better solder than HOYT Warranted can be secured, while HOYT Strictly Solder proves more than satisfactory to those wanting a medium grade product.

If your regular jobber cannot supply you, write us for the name of one who will.

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ESF

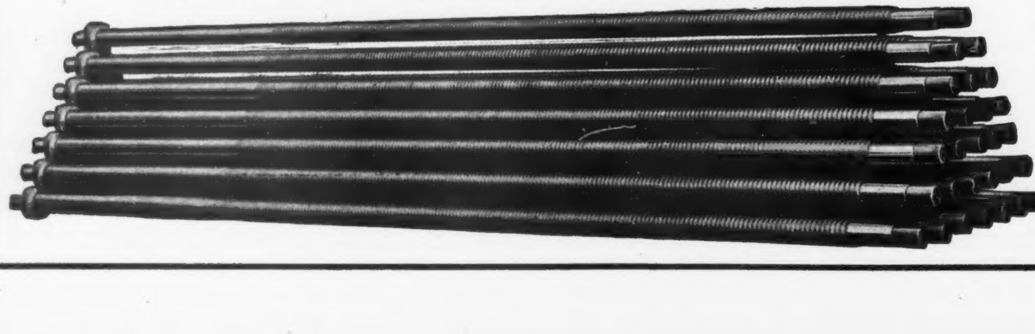
High Speed Carbon and Alloy Tool Steels, Special Alloy and Carbon Steels, Bars, Billets, Shapes.

An investigation of the adaptability of "ESF" steels for your rigid requirements will help you (as it has others) to solve your steel problem and to obtain a greater quantity of finished products at a lower cost. Write us about Special Alloy Steels, Constructional Steels, Tool Steels, High Speed Steel, etc.

ELECTRIC STEEL & FORGE CO.
CLEVELAND, OHIO

Remember Hindley When You Need Screws

They're cut with scientific accuracy on special machines; are guaranteed correct. They're strong, well finished, long-lived and economical to use. Any pitch—thread—quantity. Write for quote.



HINDLEY GEAR COMPANY
1105 Frankford Ave.
PHILADELPHIA, PA.

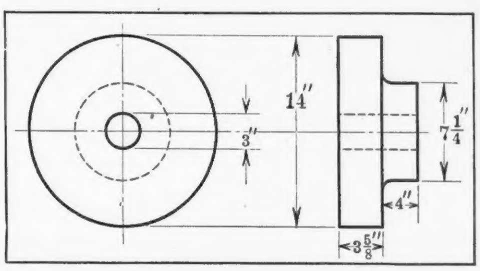
Typical J & J Better Forgings

Before they tried J & J Better Forgings, the people for whom we make these steel hubbed gear blanks used steel castings, 10 to 20 per cent of which had to be rejected after machining because of blow-holes.

The saving effected by the change is threefold—first, the elimination of rejections; second, the greater strength and durability of forged steel; third, the reduction of machining time because of the uniform closeness to finish dimensions—a characteristic of all J & J forgings.

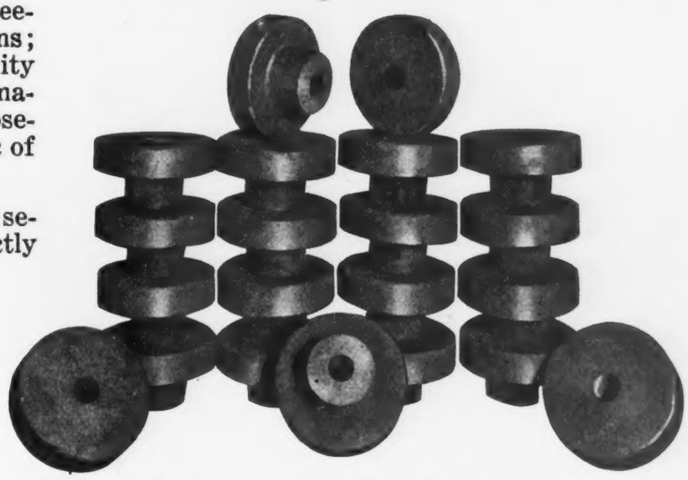
These blanks average 183 lbs. and one selected at random tipped the scale at exactly 182.

Let us estimate on your requirements.



Uniform Size—
Minimum
Machining

BETTER FORGINGS



The Johnston & Jennings Co.

Incorporated 1894
Addison Road and Lake Shore R. R. Tracks
Cleveland Ohio, U. S. A.

Save Their Cost in a Single Using

Wear-Ever Adjustable Spacing Collars

Accurately adjustable in 12 steps of .002" each, rigid as a solid collar when set—a cheap and easy way to speed milling cutter set-up.

TRY ONE

SCULLY-JONES & CO.
647 Railway Exchange Bldg.
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EXPANDED METAL SAFETY GUARD CO.
14th St. and Vernon Ave. Long Island City, N. Y.

The highest type of engineering and construction service in the design, manufacture and installation of

MACHINE GUARDS

FLEXMET

Flexible Metal Hose and Accessories

For Any Purpose Whatsoever. *Pressures up to 10,000 lbs. Sizes up to 72" Inside Diameter. Complete with Any Kind of Fittings.*
BREEZE METAL HOSE & MFG. CO., Inc. 1904
256 South Street, Newark, N. J.

Bingham Stampings

Designing the correct dies is more than half the battle in the economical production of intricate stampings. Even in the simplest it is an important factor. We have made die designing a specialty; that's the secret of the success of Bingham Stampings. Send samples or prints for quote.

The Bingham Stamping & Tool Co.
1435-7 Dorr Street TOLEDO, OHIO

DOEHLER
DIE-CASTING CO.

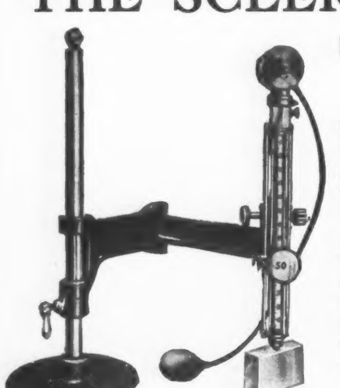
WORLD'S LARGEST PRODUCERS OF

DIE-CASTINGS

TIN-LEAD-ZINC-ALUMINUM-ALLOYS, DO-DI BRASS.

EASTERN PLANT	CENTRAL PLANT	WESTERN PLANT
BROOKLYN N.Y.	TOLEDO O.	CHICAGO ILL.
COURT, 9TH & HUNTINGTON STS.	SMEAD & PROSPECT AVES.	COTTAGE GROVE AVE & 97TH ST

THE SCLEROSCOPE



Used All Over the World

Metal workers everywhere depend on this simple, foolproof device for determining the hardness of metal; governments have adopted it as the international standard. It can be used to advantage on large work or small and requires no skill to operate.

Insures the Quality of Metal Parts

Ask us about the Shore Method of Selective Carbonizing and Hardening

The Pyroscope

The Pyrometer tells you the heat inside the furnace, but the Pyroscope shows you the temperature of the work itself. Durably constructed and easy to use. Let us tell you about it.

The Shore Instrument & Mfg. Co.
Van Wyck Ave. and Carll St. Jamaica, N. Y.

FOREIGN AGENTS: Agent for Great Britain and Colonies, Coats Machine Tool Co., Ltd., 14 Palmer St., Westminster, London, S. W.; Glasgow, Newcastle-on-Tyne. Yamatake & Co., Tokyo, Japan. Aux Forges de Vulcain, Paris, France. R. S. Stokvis & Zonen, Ltd., Belgium and Holland.

STEEL BEARING BALLS

BRASS AND BRONZE BALLS

STEEL BURNISHING BALLS

ASK FOR PRICE LIST 104

THE ABBOTT BALL CO.
ELMWOOD HARTFORD, CONN.

Take Us Up on This—

Send us a piece of scrap H. S. Steel; we'll "EL-WELD" it free of cost to a tool steel shank, and you'll have a cutting tool for nothing. A piece ½" x 1" to ¾" x 1½" will do. This will show you how our electric welding process will save you money.

THE ELECTRIC WELDING CO., 2114-16 Superior Viaduct CLEVELAND, OHIO

WOLFRAM
TRADE HIGH SPEED STEEL MARK

VULCAN CRUCIBLE STEEL CO., Aliquippa, Pa.

GOODELL-PRATT
1500 GOOD TOOLS

Instruments of Precision
for particular workmen

You have to buy precision tools largely on faith. The reputation of the maker is your best guarantee of accuracy.

The confidence and faith that toolmakers and machinists have in Goodell-Pratt Tools are never misplaced. Here are tools that are as good as money in the bank. They're made to give you long and faithful service.

Micrometers, Calipers, Steel Rules and Surface Gauges in all the standard styles and sizes

As a test—before you buy another steel rule, measure it up with a micrometer.

This simple, easy test is proof positive of the accuracy of all Goodell-Pratt Steel Rules. The more cranky you are about the tools you use, the better you'll like those made by Goodell-Pratt.

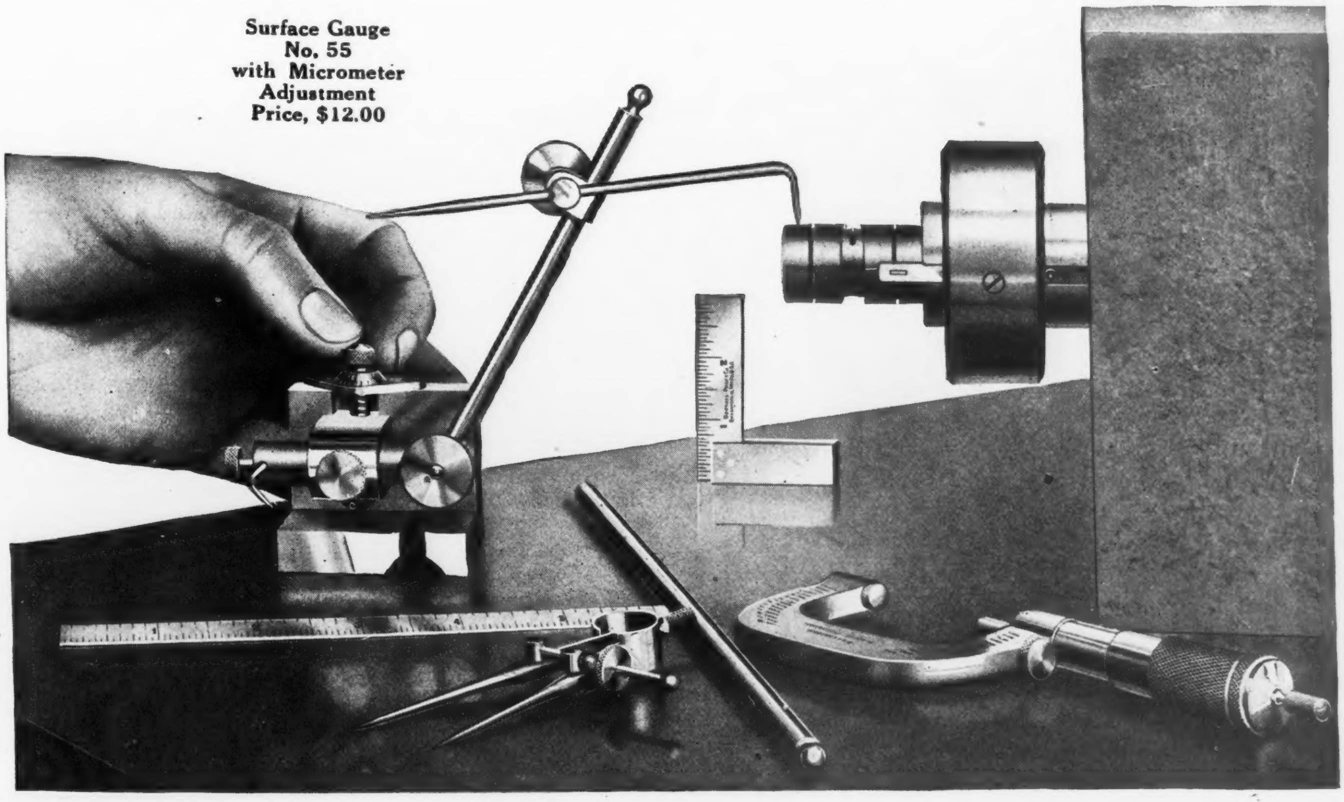
Your hardware dealer has Goodell-Pratt Tools or can get them for you. Talk to him. Ask him, or write us for a copy of our new machinist's tool catalog, "Tools for the Toolmaker," picturing and describing the very tools you have always wanted to own. It's free.

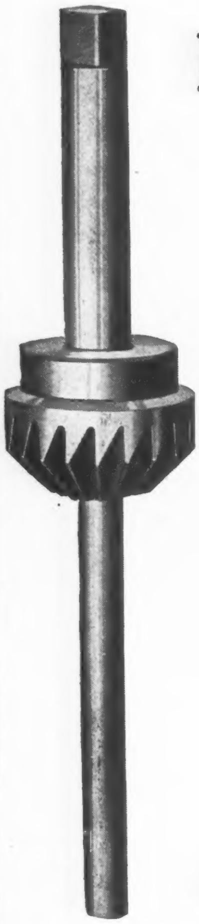
GOODELL-PRATT COMPANY

Toolsmiths

Greenfield, Mass., U. S. A.

Surface Gauge No. 55 with Micrometer Adjustment Price, $12.00





Make Quick Work of Valve Grinding

A poppet valve in your gas engine can be quickly ground to accurate fit if the valve seat is first scraped clean of carbon and heat pits.

The Sioux Valve-Seat Reamer

Slips easily down into the valve-seat, and with just a few turns cuts a smooth, clean face on the seat. Then little work remains in grinding the valve to its seat.

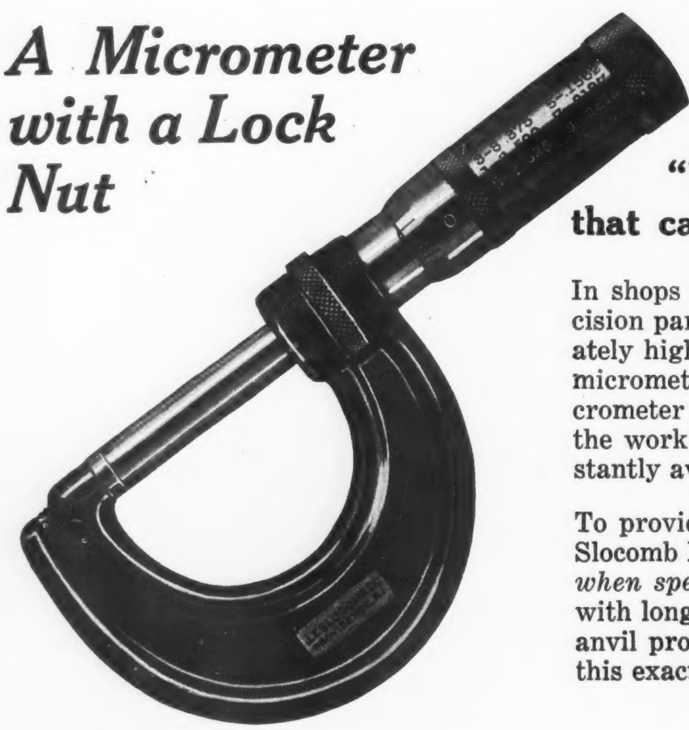
Sioux Tools For Valve-Repairing

—are just the right tools for emergency valve-jobs. They are accurate to the last degree, built to last, and any shop-hand can use them. Sioux tools will save many costly tie-ups in the factory.

Your Jobber Sells Them.

Albertson & Co., Sioux City, Iowa

A Micrometer with a Lock Nut



SLOCOMB

"The Longest Lived Micrometer that can be Bought"

In shops handling comparatively small lots of precision parts, the cost of snap gages is disproportionately high. For this class of inspection the uses of micrometers with lock nuts is recommended. A micrometer with a one-inch range can be used to handle the work of about 4000 snap gages, and is also instantly available for measuring when desired.

To provide this form of service, we now equip the Slocomb Micrometer with a simple, positive lock nut *when specified;* its unusually long tool steel screw with long bearing on the nut and the solid tool steel anvil provide the durability necessary to withstand this exacting form of service.

Catalog 16 describes the line

Reg. U. S. Pat. Office

J. T. SLOCOMB COMPANY, Providence, R.I.

CHICAGO REPRESENTATIVE: R. R. Street & Co., 26 North Clinton St. PACIFIC COAST REPRESENTATIVES: The Charles A. Dowd Sales Co., 320 Market Street, San Francisco, Calif. FOREIGN AGENTS: England: Chas. Churchill & Co., Ltd., London, Birmingham, Manchester, Newcastle-on-Tyne; and Glasgow. Japan: Alfred Herbert, Ltd., Yokohama. Italy: Charles Civita, Milan. Australia: Edwin Wood, Pty., Ltd., Melbourne and Sydney.

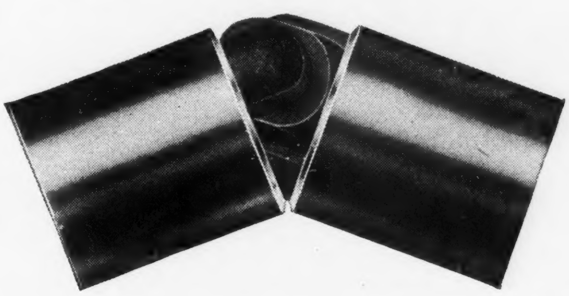
G & P
Universal Joints

For "Safety First" in Delicate Mechanisms

It is interesting to note that many designers of delicate mechanisms are making use of Gray & Prior Universal Joints for places where even a slight deflection would be fatal to the efficient operation of the machine. They counteract play, reduce vibration, and insure a smooth, uniform connection.

The wearing surfaces of G. & P. Universal Joints are scientifically case hardened, making them extremely long lived. They have no sharp corners, no screws or small parts to renew, and no corners to collect dirt.

Stock sizes range from $\frac{7}{8}''$ to $2\frac{7}{8}''$ for shafting up to $1\frac{3}{4}''$ in diameter. They will meet most needs; but where necessary "specials" can be quickly produced. Write for details.



Manufactured by

GRAY & PRIOR MACHINE CO.

38 Suffield Street **Hartford, Conn.**

Introduce Colton-Detroit High Speed Drills to Your Plant

You'll be astonished at their efficiency. They wear well and cut quickly; wide grooves prevent clogging.

Colton-Detroit High Speed Drills are made from tough, highly refined steel.

They're forged and finished by a special process; have lots of backbone. They'll stand high speeds and heavy feeds for long periods.

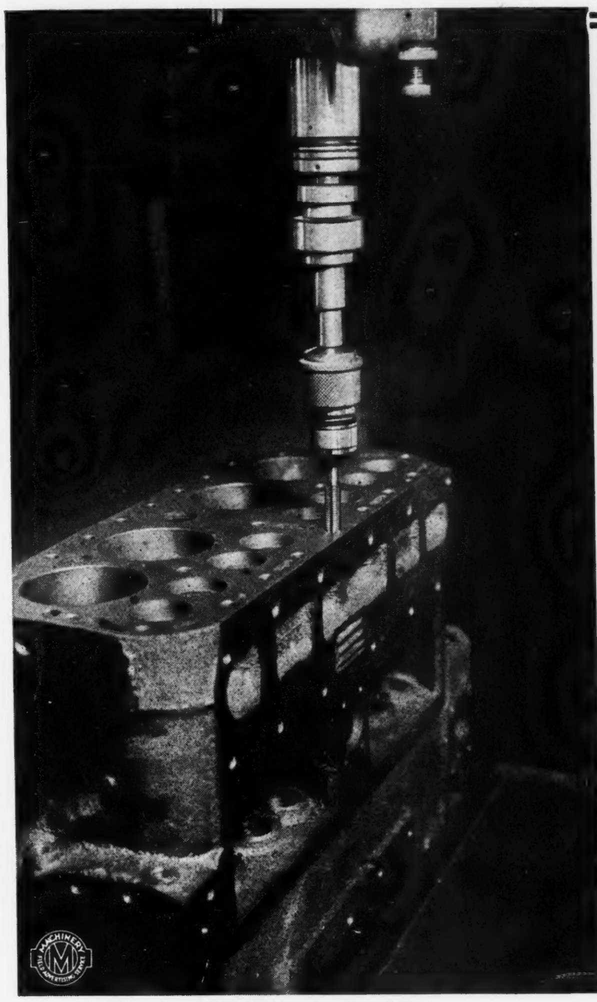
Compare the running time between Colton - Detroit Drills with that of the drill you are now using. Prove their worth to your own satisfaction.

Our catalog will give you an idea of what to expect from us. You are in no way obligated by asking for it.

ARTHUR COLTON CO.

2618 Jefferson Avenue, East, Detroit, Mich.

REPRESENTATIVES: **Buffalo:** P. F. Fosnight, Ellicott Square Bldg. **Chicago:** Illinois Metal & Tool Co., 9 South Clinton St. **Milwaukee:** General Sales Agency, 3205 Vine Street. **New York City;** F. A. Brady, Inc., 30 Church Street. **Pittsburgh:** W. E. Nagle & Son, Jenkins Arcade Bldg. **Philadelphia:** Wenson Tool Co., 824 Bulletin Bldg. **San Francisco:** L. G. Henes, 75 Fremont St. **Syracuse:** Barnes & Irving, Inc.



PROCUNIER TAP CHUCKS

Motor Manufacturers Find them Valuable Aids to Production

This one of a busy trio of Procunier Tap Chucks in use at the Supreme Motors Co. (Warren, Ohio) when this photograph was taken, is shown tapping holes in cylinder heads for automobile motors. These holes, 3/4″ deep and 7/16″ in diameter are tapped at the rate of 24 every three minutes; a production record that is consistently maintained without tap breakage. Here, as in all cases where Procunier Tap Chucks are used, correct chucking gets production, saves taps and cuts production costs.

The circular shows other installations and gives details. Send for it.

WILLIAM L. PROCUNIER

18 South Clinton Street Chicago, Ill., U. S. A.

What Stops Men Swearing?

First of all, what makes them swear most of all? Bad tools? Abso-lutely! Handles coming off files, for instance. And when they swear they don't work, so it's up to you to lay in a stock of

Osgood File Handles

They're so strong that one will outlast 20 to 30 ordinary wooden handles. A thin steel tube forced into the handle prevents splitting, takes all the strain and holds the tool so it won't pull out.

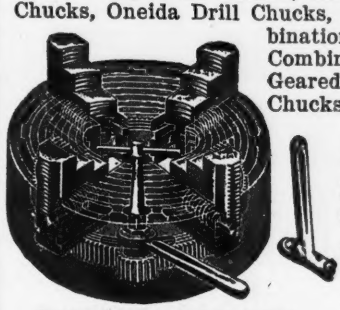
Write direct or see your dealer.

J. L. OSGOOD TOOL CO.

43-45 Pearl St. Buffalo, N. Y.

If you want the best Lathe or Drill Chucks—buy Westcott's

Little Giant Auxiliary Screw Drill Chucks, Little Giant Double Grip Drill Chucks, Little Giant Improved Drill Chucks, Oneida Drill Chucks, Spur Geared Scroll Combination Lathe Chucks, Scroll Combination Lathe Chucks, Spur Geared Scroll Universal Lathe Chucks, IXL Independent Lathe Chucks, Cutting - off Chucks.



Spur Geared Scroll Combination Lathe Chuck

Strongest Grip, Greatest Capacity Great Durability and Accuracy

WESTCOTT CHUCK CO.

ONEIDA, N. Y., U. S. A.

Ask for Catalogue

ALMOND

Teeth cut on nut giving *Direct Drive* and hardened steel Pinion Bushings which prevent wear are exclusively Almond features and insure long life.

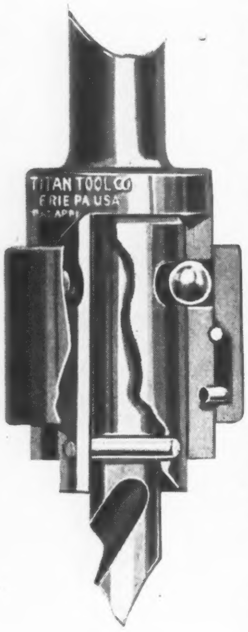
Other* ALMOND *Products

Lathe Chucks, Right Angle Transmissions, Micrometer Calipers, Flexible Steel Tubing

T. R. ALMOND MFG. CO.

ASHBURNHAM MASSACHUSETTS

Titan Positive Drive Quick Change Drill Chucks



Compact design and the quick change feature make them especially valuable for multiple drilling work. The spring - actuated ring insures efficient operation in any position.

Tool changes are made without the use of a taper drift; a self-contained drift or key is carried in the top of the collet projecting beyond it when the tool is in place. A single blow drives it down and the tool out without danger to the tool or chuck.

Efficient chucks that give good service and wear well. Made for straight or taper shank tools. Get the circular.

TITAN TOOL CO., Erie, Pa.

New York, N. Y.: Grob Hardware Corp., 36 Murray St. Boston, Mass.: W. H. J. Fitzgerald & Co., 165 High St.. Philadelphia, Pa.: Normoyle & Lapp, 514 Liberty Bldg. Detroit, Mich.: National Sales Engineering Corp., Kresge Building. Chicago, Ill.: The J. L. Stone Co., 549 W. Washington Boulevard. Cincinnati, Ohio: C. M. Bigger & Co., 414 Elm St. Hamilton, Ontario: Price & Campbell, 212 Rosslyn Ave., South.

TRUMP DRILL CHUCK

For Drills 3/8-in. and under

Small, handy and inexpensive, Trump Drill Chucks are finely finished, accurately centered, extremely durable. They are made of hardened steel, have only three parts, and are self-contained. Three sizes: No. 1 takes drills up to 1/8″, No. 2 up to 1/4″, and No. 3 up to 3/8″. Write for descriptive circular.

TRUMP BROS. MACHINE CO.

WILMINGTON, DEL., U. S. A.

Our Line is Collets

Styles and Sizes Unlimited

Collets for all standard hand and automatic screw machines for bench, tool-room and engine lathes; step collets, special collets, draw bars and adapters, we make them all and are regularly serving many first class shops.

Our collets satisfy. Our prices satisfy.

Do you know the "Inanout" Double Acting collet?

More details?

Morrison Machine Products, Inc.

"America's Collet Specialists"

Rochester New York

Lavoie Air Chucks

A New and Better Idea

Simple in construction; easy to operate.

Attached directly to main spindle, and is without gears of any kind.

Chucks put on and removed in an instant.

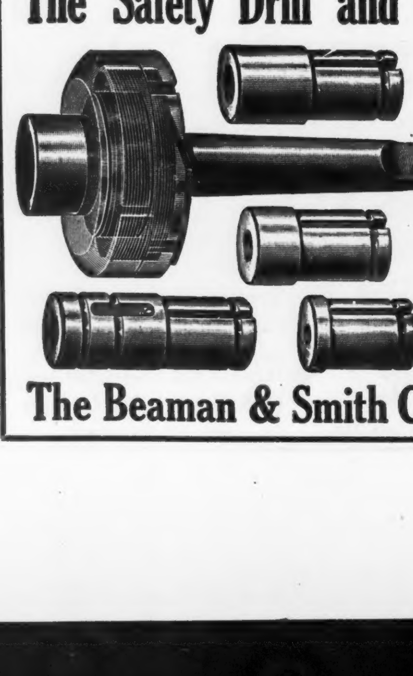
Only a thin film of air is required to operate the single acting piston, and heaviest cuts can be taken with moderate air pressure.

Write for particulars.

The Frontier Chuck & Tool Co., Inc.

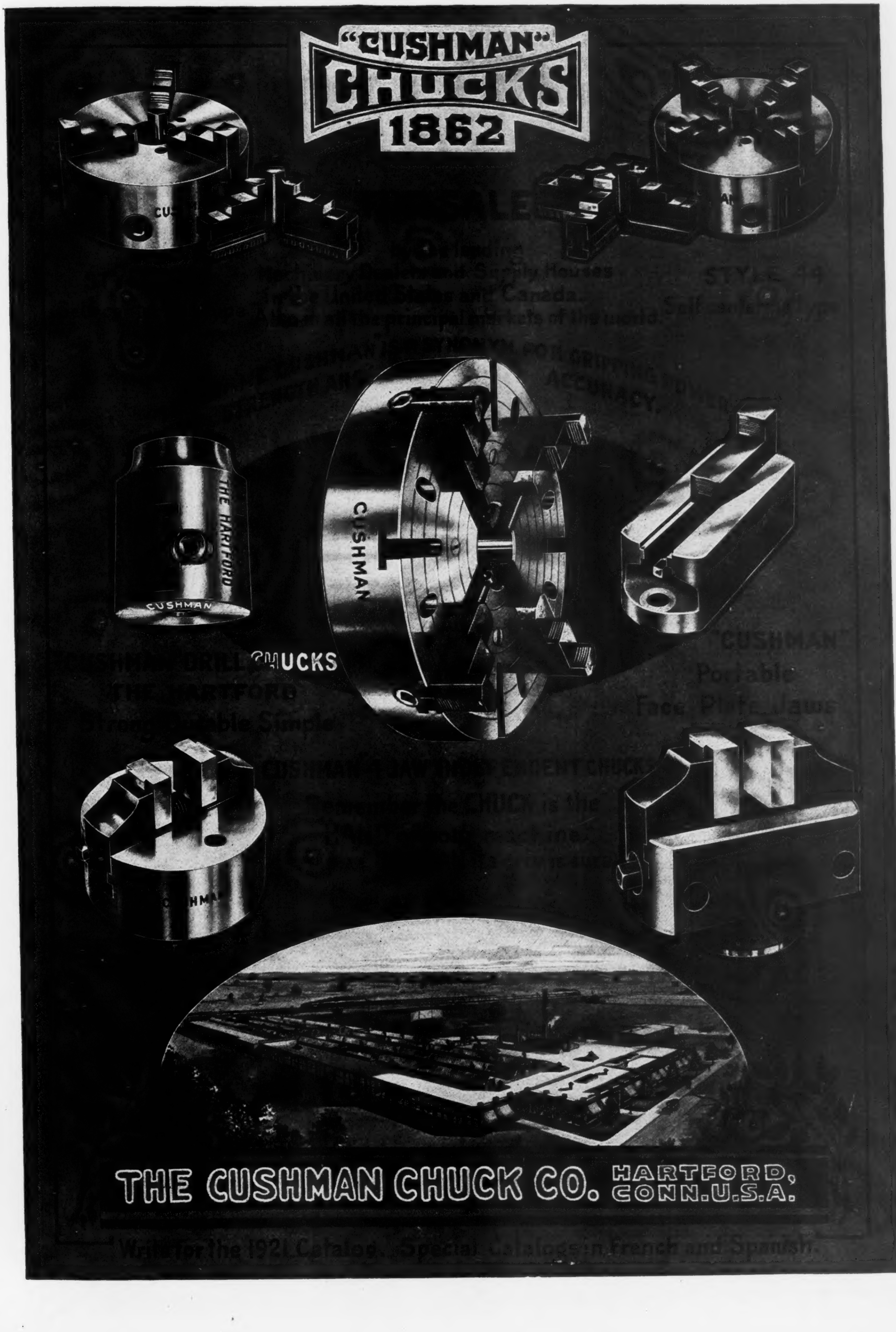
30 Letchworth Street Buffalo, New York

The Safety Drill and Tap Holder



is the only attachment for the purpose that gives universal satisfaction and is unequaled in efficiency, convenience, rapidity, accuracy and simplicity. Nothing to break or get out of order. Made in 4 sizes, covering from 0 to 2½ inches diameter.

The Beaman & Smith Co., PROVIDENCE Rhode Island



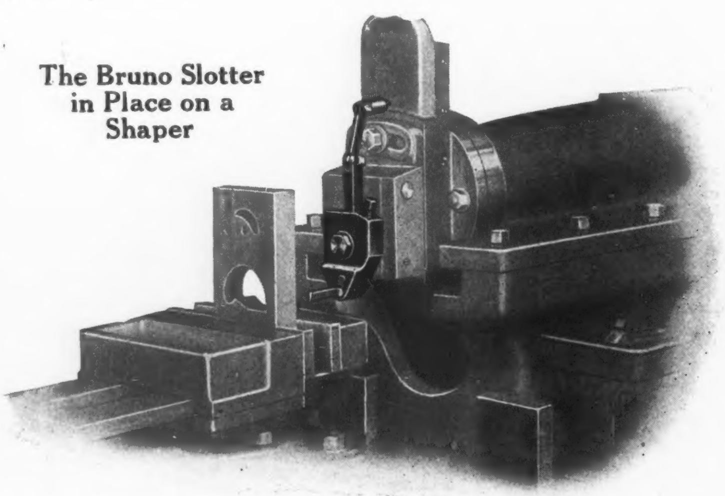
"CUSHMAN" CHUCKS 1862
CUSHMAN
THE HARTFORD
CHUCKS
THE CUSHMAN CHUCK CO. HARTFORD, CONN. U.S.A.

FIVE MINUTES' USE

is enough to demonstrate that it's going to be well worth your while to adopt the Bruno Slotting Attachment as a permanent accessory for every shaper in your plant. We want you, however, to try it out in every possible way, and we're going to let you keep it ten days without charge or obligation.

The Bruno Slotter sells for $35.00, and it gives each shaper you attach it to the efficiency of a $1000.00 slotter. May we have your address?

The Bruno Slotter in Place on a Shaper



You have your choice of three sizes:
No. 0 takes 3/8" to 1/2" Round Shank.
No. 1 takes 1/2" to 5/8" Round Shank.
No. 2 takes 5/8" to 3/4" Round Shank.
Each size is furnished with two cutting tools ready for use. State size when ordering.

H. A. Moore Co.

DEPT. M

Rochester N. Y., U. S. A.

They GLOBE Tumble Castings

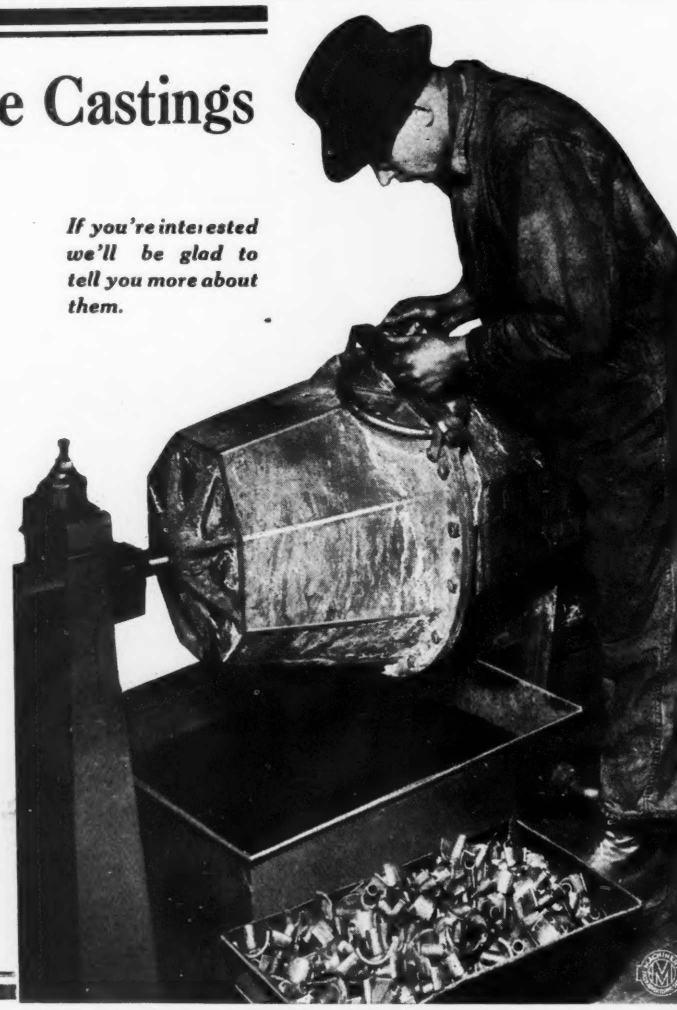
For Gabriel Snubbers to get the Finish Wanted

Five GLOBE Tumbling Barrels in continuous operation tumbling five kinds of castings; two extra barrels in reserve for special work; a thoroughly satisfactory installation in a thoroughly modern plant.

The Gabriel Manufacturing Company, Cleveland, Ohio, finds this the most efficient and economical way to clean and polish small parts. The work is tumbled wet and the average charge is 60 to 70 pounds, the average run, 50 minutes per load.

The machines are simple and never out of order; easily operated, they do not require skilled labor to get the best results.

If you're interested we'll be glad to tell you more about them.



THE GLOBE MACHINE & STAMPING CO.

1250 West 76th Street CLEVELAND, OHIO

Also Manufacturers of Sheet Metal Stampings, Dies and Tools

FOREIGN REPRESENTATIVES: J. Horstmann, 81-83 Rue Saint Maur, Paris, France; 46 Rue Juliette-Recamier, Lyons, France.

MACHINERY'S GREEN SECTION

SECOND HAND MACHINE TOOLS

BORING MACHINES

4" bar, Detrick & Harvey, floor type.
No. 2 Beaman & Smith, floor type 4" spindle, motor drive.
2½" bar, Bement Niles horizontal.
No. 1—3" Lucas horizontal.
34" Colburn vertical turret head.
38" Niles vertical, 2 heads.
60" Rogers & Hemphill, vert. 2 heads.
No. 1 Rockford horizontal.

DRILLS

No. 2—2 spindle Avey sensitive BB.
3 spindle Henry & Wright sens. BB.
No. 43—3 spindle Taylor & Fenn sens.
20" Style M Baker Bros., heavy duty.
20" Prentice Bros. sliding head, BG.
23" Rockford, slid. hd., tapping att.
24" Pratt & Whitney stat. head, BG and power feed.
28" Sibley sliding head, BG and power feed.
42' Cinn. Bick. sliding head, BG, PF, cone drive, tapping att.
No. 310 Baker Bros. heavy duty.
D2 Colburn heavy duty.
4½' Dreses plain radial, tapping attachment.
6 sp. Hendey, power feed to each spindle.
No. 30—12 spindle Bausch multiple.
No. 12—8 spindle Natco multiple, ¾" sp.
No. 22—16 spindle Natco multiple, 1" sp.

GRINDERS

3" x 18" Norton plain cylindrical.
5" x 18" Ott plain cylindrical.
6" x 32" Norton plain cylindrical.
10" x 48" B. & S. plain cylindrical.
10" x 30" Landis plain cylindrical.
12" x 36" Modern plain cylindrical.
No. 18—12" x 120" Landis plain.
14" x 40" Queen City, plain.
18" x 96" Norton plain, self-contained motor drive.
No. 3—12" x 40" Modern universal.
No. 1 Diamond autom. surface.
10" Garrigus rotary surface.
No. 1 Cinn. cutter and tool.
No. 1 Norton univ. cutter and tool.
No. 2 Norton univ. cutter and tool.
No. 11 Rivett oscillating.
B. & S. oscillating ball race.
No. 5 Rivett hand feed oscillating.
No. 6A Bryant internal.
No. 34 Van Norman internal, water aft.
No. 6 Rivett internal.
20" Besly disc, geared lever tables.

LATHES

No. 5 Rivett bench, slide rest.
14" x 6' Prentice Bros. CR, PCF.
14 x 6 Reed, CR, PCF.
16 x 6 Porter, CR, PCF.
16 x 8 Flather, QC, CR, PCF.
18 x 8 Prentice Bros. geared head chuck.
22 x 8 Schumacher-Boye, CR, PCF.
22-24 x 8 Lodge & Shipley selective head, manufacturing.
32" x 14' Hamilton, CR, PCF.
26" x 12' Putnam, CR, heavy duty.
38" x 20' New Haven, CR. PCF.
56" x 24' Wood & Light. CR, PCF.
3½" x 60" Fitchburg Lo-Swing.

MILLERS

No. 14 Garvin plain.
No. 2 Cincinnati plain, all feeds.
No. 2A Kempsmith plain, BG.
No. 3 Cincinnati plain, cone drive.
No. 4 Cincinnati plain, all feeds.
No. 1½ LeBlond univ., motor drive.
No. 2 Brown & Sharpe univ.
No. 3 Cincinnati high power vertical.
No. 4 Cincinnati high power vertical.
No. 4B Becker vertical cone drive.
No. 5 Hendey Lincoln type.
No. 12 B. & S. mfg.
Rivett bench, hand.
36" x 10' Newton side slab, motor drive.

TURRET MACHINES

16" x 5' American Fox, solid spindle.
16" Acme univ., friction BG.
24" Steinle heavy duty, geared head.
20 x 10 Fay & Scott univ. turret lathe.
24 x 10 Lodge & Davis turret.
24" Gisholt turret, 6" hollow spin.
2 x 24 J & L flat turret bar equipment.
3 x 36 J & L chuck or bar equipment.
¾" Bardons & Oliver turret, motor.
No. 1—7/16" capacity P & W, wire feed.
No. 2½ Garvin screw mach. air chuck.
No. 3 Windsor wire feed screw machine.

MISCELLANEOUS

Broaching Machine, No. 4. J. N. Lapointe
Centering Machine, 3", 2 spin., P. & W.
Compressor, 8 x 8 Clayton single air.
Gear Cutter, 34" x 10" B. & S. spur.
Keyseater, No. 2 Mitts & Merrill.
Motor, 2 HP., 115 V. D.C.—2 to 1 variable speed.
Motor, 3 H.P., 1200 R.P.M., 220 V., 60 Cy., 2 Ph.
Dynamometer, Sprague, 250 V., D.C., 775-1800 R.P.M.
Motor, 7½ H.P., 220 V., 60 Cy., 2 Ph., 1720 R.P.M.
Motor, 5 H.P., 110 V., D.C., 1300 R.P.M.
Planer, 24 x 24 x 6 Flather, 1 head.
Planer, 26 x 24 x 7 Gray, 1 head.
Planer, 30 x 30 x 8 Pond, 2 heads.
Planer, 36 x 30 x 14 Cincinnati, 3 heads.
Planer, 36 x 36 x 8 Pond, 2 heads.
Planer, 36 x 36 x 12 Cincinnati, heavy pattern, 4 heads, slightly used.
Planer, 36 x 36 x 12 Pond, 2 heads.
Planer, 48 x 48 x 15 Sellers, 3 heads.
Planer, 60 x 60 x 30 Bement, 3 heads.
Planer, 60 x 48 x 14 Gleason, 2 heads.
Press, No. 19 Bliss plain inclinable.
Press, No. 72 Ferracute, straight sided.
Press, No. 103 Ferracute, double action.
Profiler, No. 13, P. & W., 1 spindle.
Saw, 18" Newton circular.
Shaper, 14" P. & W. crank.
Shaper, 14" Springfield crank.
Shaper, 15" Potter & Johnston universal.
Shaper, 15" Hendey friction.
Shaper, 24" Hendey friction.
Surfacer, 26" x 3" Crescent wood.
Tapper, 6 spindle Acme ½" semi-autom. nut.
Welder, No. 6A National, Butt.

HENRY PRENTISS & COMPANY
Incorporated

New York, N. Y. — **Warehouse, Jersey City**

BOSTON BUFFALO HARTFORD SYRACUSE ROCHESTER

Priced to Sell Under Present Conditions
Over 400 Machines in Stock at Our Warehouse

BORING MILLS

100" Betts, 3 heads, like new.
76" Betts, heavy, modern.
60" Niles-Bement-Pond, heavy, Single pulley drive.
60" Bickford standard, 2 heads low price.
36" Bullard, vertical turret.
8-24" Bullard, vertical turret.
3½" Horiz. Universal, belt driven.
4" Espen-Lucas Horiz. floor type.
3" Betts, horiz. knee type.

DRILLS

8' Niles Plain Radial.
6' Baush Plain Radial, like new.
6' Bickford semi-univ. Radial.
5' Niles-Bement-Pond, motor driven.
4' Gang, gear-box drive.
2—28" Aurora Upright S.H. B.G. NEW.
6 Spindle Baush 1" capacity.
3 and 4 spindle Barnes 20" gang.
2 Spindle Foote-Burt heavy rail type.
6 spindle Rockford—automatic feed.
4 and 6 spindle Allen—sensitive.

LATHES

60" x 20' Fifield D.C. motor drive.
52" x 22' New Haven triple geared pulley drive.
60" x 17' New Haven Pulley.
36" x 14' Putnam triple geared.
36" x 12' Pond triple geared.
30" x 12' Johnson.
28" x 18' Johnson.
20" x 8' and 10' Americans.
20" x 8' Lodge & Shipleys.
14" x 6' Mulliner Tool-room.
14" x 6' Monarch.
12" x 5' P. & W.
10" x 4' Seneca Falls.

MILLING MACHINES

8 No. 5C Becker Verticals, new, price right.
No. 3 LeBlond, plain, high duty.
No. 5 Becker-Brainard Plain.
No. 2 Kempsmith Universal.
50" x 8' Ingersoll Slab.
No. 25 Becker Plain.
No. 2 Hendey Norton Plain.
No. 1½ Hendey Norton Universal.
No. 2 Van Norman Duplex.
31" x 5' Newton Vertical Slab.

PLANERS

84" x 84" x 13' Sellers, 3 heads, belt driven.
48" x 48" x 14' Powell, 4 heads, reversible motor drive, complete with electrical equipment.
48" x 48" x 16' Bement-Miles, 4 heads, belt driven.
42" x 42" x 12' Pond Machine Tool Co., 2 heads, belt driven.
36" x 36" x 12' Niles-Bement-Pond, 3 heads.
30" x 30" x 10' Flather, 2 heads, belt driven.
30" x 30" x 6' Gray, 3 heads, parallel drive.

PRESSES

No. 55 Adriance S. A.
No. 512 Bliss triple action.
No. 1 Farrel straight side 8" stroke.
D.D. 4 Ferracute D.A. roll feed.

SHAPERS

2—16" Newark box table and vise.
4—15" Hendey, box table and vise.
4—15" Smith & Mills, box table and vise.
3—48" Morton, extra heavy draw cut.
18" Fitchburg traveling head.

MISCELLANEOUS

10' Bement Boiler Plate Rolls.
18" Betts heavy type Slotter.
12" New Haven Slotter.
Sellers Heavy Punch 2" capacity.
No. 12 Buffalo Slitting Shear (new).
Newbold Rotary Shear ¾ capacity.
10" Newton Slotter (NEW).

GRAVES MACHINERY EXCHANGE

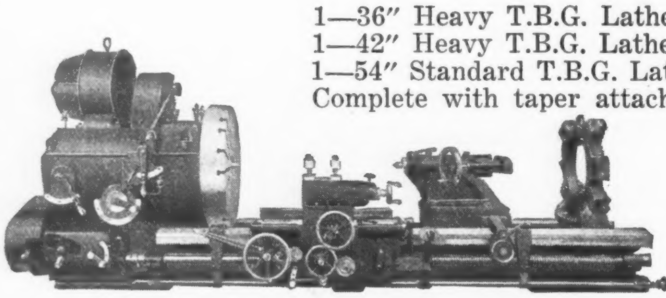
482 HUDSON TERMINAL — **NEW YORK CITY, N. Y.**

Warehouse and Machine Shop, Johnson Ave. and Monitor St., Jersey City, N. J.

Large Lathes for Immediate Delivery

Subject to Prior Sale

1—36″ Heavy T.B.G. Lathe with 26′ Bed.
1—42″ Heavy T.B.G. Lathe with 36′ Bed.
1—54″ Standard T.B.G. Lathe with 40′ Bed.
Complete with taper attachment, electrical equipment, etc.



Write or wire for full specifications

The Houston, Stanwood & Gamble Company, Inc.
CINCINNATI U. S. A.

Russell Machine Company
28th St. and A. V. R.R. PITTSBURGH, PA.

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30″ Warner & Swasey Vertical
36″, 60″, 90″ Niles Vert., 2 hds.
42″ and 50″ Bullard Vert., 2 hds.
72″ Pond. Vert., 2 hds.
Garvin No. 12 Plain Miller
LeBlond No. 3 Plain Miller

DRILL PRESSES
20″ Silver Drills, Plain and Bk. Gd.
20″ Champion, Plain and Bk. Gd.
32″ Gould-Eberhardt B.G.
36″ Snyder B.G. Drill
40″ New Haven B.G.
3′, 5′, 6′ and 7′ Prentice Radial Tap. Att.
5′, 6′, 7′, 8′ Pond Radial
9′ Baush Radial

PRESSES
Bliss No. 18 Inclinable Power Press
Stiles Nos. 3 and 23 Inc. Power Presses
Garrison Dbl. Crank Sgl. Grd. 250-Ton
Niagara No. 116-A Power Press, M.D.
Bliss No. 75½ S.S. Geared, 6″ str.
Bliss No. 76½ Str. Slide, D.G., 8″ stroke
Corry Mch. Co., 12″ stroke
No. 56 Double Housing Power Press

PUNCHES—SHEARS
No. 45 Buffalo Punch ⅝″ x ½″
Reade 50″ Th. S.E. Punch and Shear
Carlin Alligator Shear cap. 2¼″ sq.
Garrison M.D. Alligator Shear 15″, knife, cap. 3″ sq., wt., 36,000 lbs.
Doelger & Kirkstein No. 4 High Knife Alligator Shear, cap. 4¾ round
Morgan Plate Shear, 96″ bet. housing, cap. 1″ thick
Mesta Plate Shear, cap. ¾″ x 156″
Garrison Plate Shear, cap. ⅞″ x 81″
Schatz Punch and Shear Hand Power, 7½″ thr.

LATHES
48″ x 32′ N.B.P. Triple Geared
48″ x 26′ Pond Triple Geared
48″ x 28′ Niles, C.R. Faceplate Drive
28″ x 12′ Boye-Emmes, q.c.g., d.b.g.
27″ x 12′ Pittsburgh, D.B.G.
36″ x 20′ x 6″ Putnam B.G. C.R.
24″ x 16′ 6″ Johnson, C.R.
26″ x 10′ x 6″ Walcott, q.c.g.
19″ x 10″ LeBlond M.D., 220 V., D.C.
18″ x 8′ Sidney, q.c.g.
18″ x 8′ Mueller, Q.C.G. (New)
16″ x 6′ Columbus, Q.C.G. (New)
14″ x 6′ Hendey, q.c.g.
24″ x 6′ Gisholt Turret, 6¼″, H.S.
22″ x 8½′ Bullard Turret

PLANERS AND SHAPERS
20″ x 20″ x 51″ Planer, 1 hd.
24″ x 24″ x 8′ Chandler 1 hd.
72″ x 56″ x 12′ Betts Planer, 2 hds.
48″ x 48″ x 12′ Sellers, M.D., 4 hds.
24″ Stockbridge Shaper
24″ Cincinnati B.G. Shaper, M.D.
24″ Walcott Geared Shaper

MISCELLANEOUS
100 and 200-lb. Power Hammers, Belted
2500 Bement-Mills Dbl. Leg. Steam Hammer
2500 Chambersburg D.L. Steam Hammer
3″ National Heading, Upsetting Machine
Contractors Steam Hoist with 8 H.P. Boiler and 5 H.P. Engine
Plymouth Grinders Nos. 13-14-17-20
Greenfield Un. Cutter and Tool Grinder
Niles 15″ Slotter
Cleveland Straightening Rolls, 84″ x 10′
Landis 1¼″ Bolt Cutter
Buffalo Blowers, Vol. and Pressure
U. S. Buffer, spindle 53″ x 1″, m.d.
Greaves-Klusman 36″ Band Saw
Chicago Pneu. Air Comp., 8″ x 8″

USED MACHINERY
Immediate Delivery

34″ Colburn Vertical Boring Mill
38″ Bridgeport Vertical Boring Mill
60″ Bullard Vertical Boring Mill
60″ Betts Horiz. Boring Machine
22″ G. & E. Sliding Head Drill (2)
No. 25—24″ Foote-Burt Hvy. Duty Drill
2½″ Fosdick Plain Radial Drill
28″ Aurora Sliding Head Drill
32″ W. F. & John Barnes Sliding Head Drill
10″ x 26″ Ott Universal Grinder
No. 11 Landis 8″ x 32″ Plain Grinder
No. 1 Sellers Patent Tool Grinder
No 3 B. & S. Plain Grinder
No. 16, 10″ x 72″ B. & S. Plain Cylindrical Grinder
No. 3 26″ B. & S. Gear Cutter
800-lb. Massillon Steam Hammer
800-lb W. W. & Co. Board Drop Hammer
18″ x 8′ Whitcomb Blaisdell Lathe. Q.C.G.
18″ x 10′ Prentice Lathe. Q.C.G.
20″ x 14′ Putnam Lathe
33″ x 16′ Bridgeford Heavy Duty Lathe
No. 3 Burr Keyseat Miller, Routing Attachment
No. 33 Kempsmith Production Miller
24″ x 24″ x 8′ Ingersoll Slab Miller
No. 2 Milwaukee Universal Miller
No. 2 M. P. & J. Horiz. Auto. Miller
No. 2 M. P. & J. Vertical Auto Miller
62″ x 56″ x 26″ Gray Planer, 2 heads
36″ x 36″ x 8′ Betts Planer
36″ x 36″ x 12′ Woodward & Powell Planer
No. 73 ¾ Bliss Straight Sided Geared Press
No. ½ Toledo O. B. I. Punch Press
No. 57 Toledo Straight Sided Geared Press
No. 76 Toledo O. B. Press.
No. 38 Niagara Geared Punch Press
2″ x 2½″ Cleveland Auto Screw Machine
No. 252 Niagara Power Shear
72″ Loy & Nawrath ¼″ cap. Power Shear
2″ x 24″ Jones & Lamson Turret Lathe
No. 2 Pratt & Whitney Turret Lathe

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551-557 Washington Blvd. CHICAGO

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9—No. 60½ Bliss Reducing Presses, $500 ea.
11—Lees-Bradner Thread Millers, $250 each.
3—3x36 J. & L. Flat Turret 2 spindle machines, $500 each.
4—3x36 Stevens Flat Turret single spindle machines, $450 each.
1—Bridgeport 26x9″ Turret Lathe, $600.
1—American 22x8′ Turret Lathe, $500.
1—No. 2 Cincinnati Universal Miller, $750.
1—No. 1-B LeBlond Plain Miller, $800.
1—24x24x7½ Deitrich & Harvey Open Side Planer, $1250.
1—40″ Prentiss Radial Drill, $400.
2—24″ Baker Heavy Duty Drills, $400 ea.
5—14x6 Reed Plain Turning Lathes, $150 each.
1—Boilermakers roll, steam driven, 16′ 4″ between housings, top roll 20″, 2 bottom rolls 14″, capacity 1″ plate.

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New Surplus Material
One-Third Regular Price

H. S. MILLING CUTTERS.

EMERY WHEELS. For P. & W. 14″ Surface Grinder Elastic Wheels. 3/32 x 3″ to 12″ dia.

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TOTE BOXES. 24 x 10 x 5 — 16 Gauge.

ADJUSTABLE DRILL HEADS. 3/16″ capacity.

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Rebuilt Machinery

"Known by every user for its Quality, and to be Invariably as Represented."

Over One Thousand Machines in stock. Get our offerings to meet your needs.

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FORT WAYNE, IND.

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If you have some machine tools you no longer need, turn them into Cash! Sell them through the Green Section.

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400 H.P. Steam Plant, Engine, Two Boilers, Oil Separator, Feed Water Heater, Pumps, Generator, Motors, Etc.

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Practically New

3′ Late Type Cincinnati-Bickford Radial Drill Single Pulley, Tapping Att., $800.

18″ x 10′ Greaves-Klusman Latest Type Double Back Geared Lathe. Used six months. Like new, $750.00.

No. 1½ Cincinnati Miller, late type, 95 per cent new, $600.

50″ Bickford Vertical Boring Mill, single head, excellent condition, $1,000.

All above with Full Equipment and Strictly Latest Type Tools.

Guaranteed A1 Working Condition

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CINCINNATI OHIO, U. S. A.

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PARTIAL LIST

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1—No. 9 Stewart gas oven furnace.
1—14″ Lees-Bradner gear generator.
1—No. 15 Gardner plain bearing disc grinder.
1—No. 24 Gardner vert. spindle horiz. disc grinder.
1—5″ x 32″ Norton plain grinder.
1—17″ x 6′ Greaves-Klusman lathe with D.C. motor.
1—New No. 3 Van Norman double miller.
1—26″ x 26″ x 8′ Whitcomb-Blaisdell planer, two heads.
1—No. 1 Southworth ⅝″ screw machine.
1—New 1⅝″ x 10″ Millholland screw machine.

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10—Brown & Sharpe No. 2 Universal Millers, latest type, complete with Dividing Heads (Like new).
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1—Gang 2½′ Heavy Duty Radial Drill, B.G.P.F. with chuck. (Like new).
75—10″ Bench Drills with chucks. (New).
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10—6″ Power Hack Saws. (New).
12—Manville No. 5C Power Presses. (Like new).
1—Snyder 24″ Drill Press, B.G.P.F. with chuck. (Like new).
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84″ x 84″ x 32′ Putnam, 4 head.
66″ x 66″ x 20′ New Haven, 2 head.
54″ x 54″ x 16′ Sellers, 4 head.
48″ x 48″ x 16′ Bement-Miles, 2 head.
44″ x 44″ x 12′ Pond, 4 head.
36″ x 36″ x 12′ Niles, parallel drive.
24″ x 24″ x 6′ Pease.
16″ Rockford
14″ Niles traveling head.
14″ Smith & Mills Crank.

Turret Lathes and Screw Machines

1½″ Tilted Turret Friction Back Geared.
2″ x 24″ and 3″ x 36″ J. & L. Sing. Pul.
No. 2 Warner & Swasey Hollow Hex., 2¼.
National Acmes No. 52, No. 53, No. 56.

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Wells, Cutter & Tool, new (2).
W. & M. Surface No. 1 and 78.
10″ x 30″ W. & P. Univ., new.
10″ x 24″ Landis Universal.
10″ x 24″ Norton, Plain.

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28″ x 12′ Fay & Scott
25″ x 14″ Schumacher-Boye
16″ x 8′ Columbus Quick Change, new.
14″ x 6′ Hamilton
10″ x 5′ Summit (4).
8″ x 60″ Fitchburg Low Swing.

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Sensitive 1, 2, 3, 4, and 6 Spindle.
Sliding Head 24″, 26″, 28″ and 32″.
No. ½ Avey Bench High Speed (3).
3½′ Morris, plain gear box.
Canedy-Otto Plain new.

Presses

No. 6-A Willard 3400 lbs. inclinable.
No. 1½ Robinson 1500 lbs. inclinable (3).
Perkins Dbl. Crank. 16″ x 24″ Bolster.
No. 2 Loshbough-Jordon O.B.I.

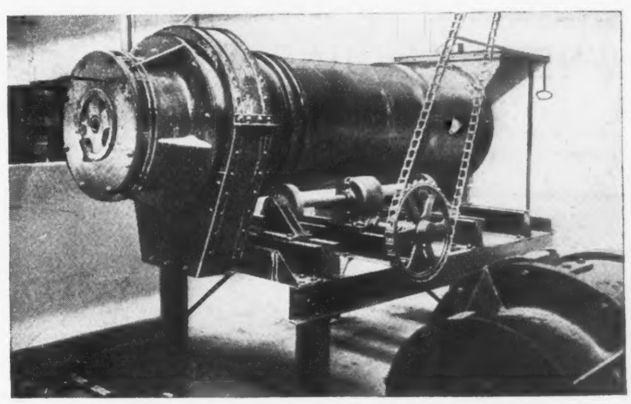
Milling Machines

No. 32 Kempsmith Lincoln Type (3).
No. 1 Knight Milling & Drilling.
No. 2 Heavy B & S Plain
Gooley & Edlund Briggs Type (3).
No. 1½ B & S Plain.
No. 25 Becker Plain (2).

Miscellaneous

Hammer, 40 lb. Bradley Cushioned Helve.
Hammer, Toledo 5000 lbs. Fric. Board.
Gear Cutter G & E 36″.
Oil Groover Garvin, nearly new.
Compressors, 8 x 8 and 12 x 10.
5′ and 8′ Robinson Squaring Shear.
Motors ½ to 50 H.P., 3 phase G.E.
Punch and Shear ½″ x ½″—12″ throat.

SIX 20′ DRILLS—SPECIAL—$123.50 EACH
Absolutely New — Standard Makes in Original Factory Crates



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Here is an unusual opportunity to get a furnace that is well worth having, at a bargain price. A recent large purchase enables us to make this offer.

5 No. 152 Rockwells

Length of furnace shell 8′
Dia. inside furnace shell 30″
Dia. inside lining 18″
Pitch of thread 8½″
Length over all 12′
Height to center of charging spout 4′ 10″
Height over all 6′ 6″
Width over all 5′ 10″
Weight complete 10,000 lbs.
Oil consumption per hour, U. S. Gals., 4
Work capacity per hour, 1000 lbs.
Horsepower required, 1

Price $600 each F. O. B. Bridgeport, Conn.

J. L. LUCAS & SON Inc
LUCAS MACHINERY SERVICE
BRIDGEPORT, CONN.

USED TOOLS

BORING MILLS

No. 32 Lucas Horizontal, 3¾" spindle, motor drive.
No. 1 Beaman & Smith Horizontal.
54" Bullard Vertical.
34" King Vertical Turret Head Boring Mill.
34" Colburn Vertical Turret Head Boring Mill.
37" Colburn vertical turret head boring mill.

GEAR CUTTERS AND GENERATORS

11" Gleason Automatic bevel gear generator.
No. 612 Fellows Gear Shaper
No. 6 Bryant Chucking Grinder.
10 x 50 Norton Plain Grinder
20" Taylor & Fenn Wet Tool Grinder.
Garvin Hand Feed Surface Grinder.

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Large size Thurston DieMiller.
No. ½ Van Norman Duplex.
No. 1 Garvin Universal.
No. 1B Milwaukee Universal.
No. 3 Becker Vertical.
No. 4 Hendey Lincoln type.
Gooley & Edlund type A Briggs.
3B Becker Plain Miller.

PLANERS

17 x 17 x 4' Whitcomb.
22 x 22 x 5' Whitcomb.
24 x 24 x 6' Whitcomb.
30 x 30 x 8' Whitcomb.
30 x 30 x 10' Powell.
42 x 42 x 18' Woodward & Powell.
60 x 60 x 12' Woodward & Powell.

DRILLS

1 spindle Allen b.b.
3 spindle Reed-Prentice b.b.
4 spindle Reed-Prentice b.b.
28" Hoefer.
26" H. & W. Sensitive Radial.
4' Fosdick Radial SPD late type.
5' Fosdick SPD speed box.
6' American Radial SPD.

MISCELLANEOUS

2¼ x 24 J & L Flat Turret Lathe.
21" x 10' Roulsted Engine Lathe.
Rockford Shaft Straightener 10'.
20" Burke Cold Saw.
No. 2B Cochrane & Bly Cold Saw.
50 lb. Standard Plain Drop.
200 lb. Automatic drop.
No. 9 Manville Embossing Press.
No. 1 Standard Broaching and Drawing Press.

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Exceptional Values In New and Used Machine Tools

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Used Machinery for Immediate Delivery

The preceding pages of the Green Section have offers of unusual value in used machine tools.

But—you may not be able to find just what you want there. Then MACHINERY'S Inquiry Department is at your service. Write us. We shall be glad to put you in touch with the right kind of machines without charge.

8-21

MACHINERY'S Green Section, Date..............................
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Name ....
Address ....

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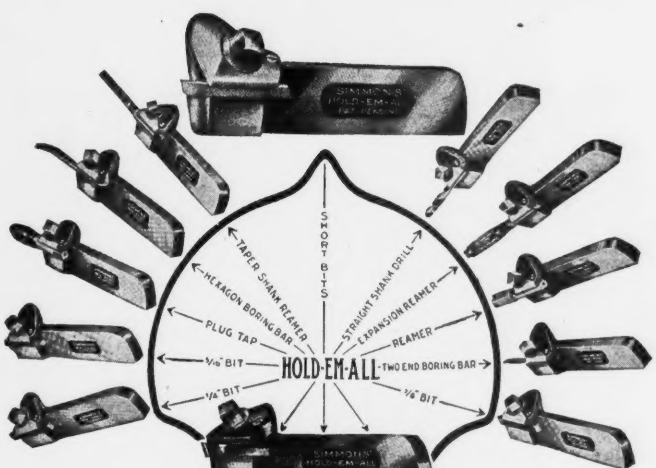
Use a "Hold-Em-All" and Economize



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Holds short bits.
Prevents breaking of bits.
Especially adapted for Stellite.
Combines many Holders in one.

Made right and left-hand off-set and straight shanks and conforms to all types of competitive makes.

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Consult your Mill Supply House.

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The Western Tool & Mfg. Co.
SPRINGFIELD, OHIO, U. S. A.

Taylor Cross Current Spot Welding

Cuts Production Costs 50 to 90 Per Cent.

Double electrode points increase output—reduce cost of labor, maintenance and power consumption; permit welding heavier material.

Try one for 30 days and see for yourself.
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THE TAYLOR WELDER COMPANY, - Warren, Ohio

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BE SURE AND SPECIFY

"WILMINGTON FIBRE" SHEETS RODS TUBES WASHERS, Etc. SPECIALTIES

WILMINGTON FIBRE SPECIALTY CO., Wilmington, Del.
BRANCH OFFICES "EVERYWHERE"

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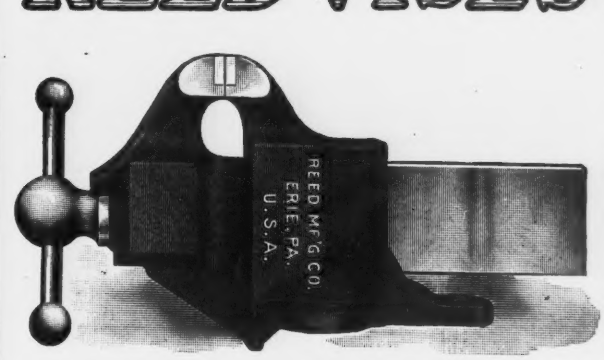

Reed vises have been developed to secure the greatest degree of rigidity possible. The need of a vise is a need for rigidity. Our tests show Reed vises are the most rigid obtainable. Reed Vises because so rigid are also much stronger.

Send for folder on "Rigidity"

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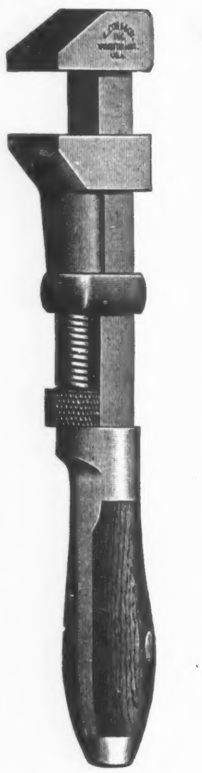

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In quality Coes Wrenches stand alone. In durability and strength they are unequalled.

"Coes" come in three models, and in sizes from 6 inches to 6 feet. Ask for Coes Wrenches —everywhere.

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The New Buhr PATENT Multiple Drill Head

Convert your single spindle drill press for multiple drilling, quickly and easily. Fully adjustable, this head will perform at least 80% of the work now requiring specially set fixed drill heads.

Made in sizes to drill from 3 to 12 holes. The price is attractive—the results good. Get the Details.

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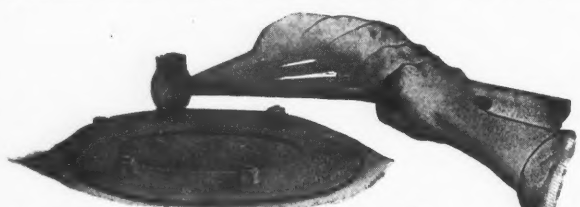
Don't Waste Time Turning Nuts With An Old-Fashioned Wrench



USE A

Favorite Reversible Ratchet Wrench

which is a time-saver because its movement is quick and positive, cutting out all the lost motion of the old-fashioned open end wrench.

Cannot slip off the nut and bark the knuckles.

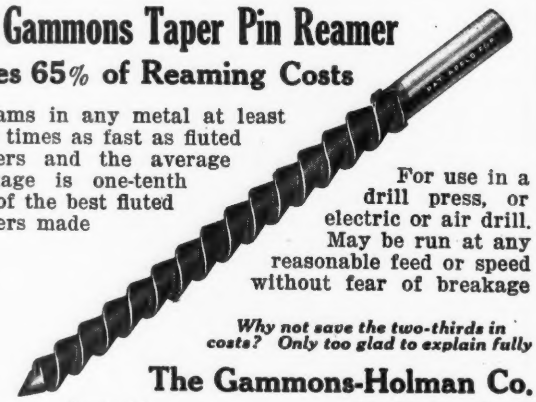
GREENE, TWEED & CO.

Sole Manufacturers

109 Duane St., New York

The Gammons Taper Pin Reamer

Saves 65% of Reaming Costs



It reams in any metal at least three times as fast as fluted reamers and the average breakage is one-tenth that of the best fluted reamers made

For use in a drill press, or electric or air drill. May be run at any reasonable feed or speed without fear of breakage

Why not save the two-thirds in costs? Only too glad to explain fully

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of the best quality.

AMERICAN BROACH & MACHINE CO.

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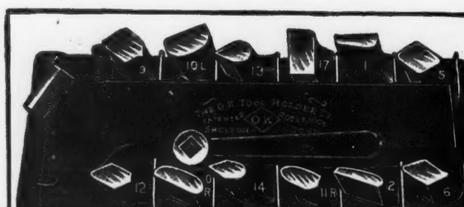

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THEO. K. TOOL HOLDER CO.

Shelton, Conn.

Trade **H&G** Mark

Simple As Can Be!

The H & G Self-Opening Die Head is
simple in design
simple in construction
simple in operation

Simplicity in **design** means perfect work.
Simplicity in **construction** means maximum strength.
Simplicity in **operation** means no worry, no trouble.
Made in three styles, adaptable to all machines.

Prove it in Your Own Shop

Try H & G Die Heads in your own shop. Prove to your own satisfaction that they will improve and increase the quality and the production of your threading. We will gladly send one to any responsible concern for 30 days' use without obligation.

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Single and Double Spindle Threading Machines, Chaser Grinders, Screw Machine Products

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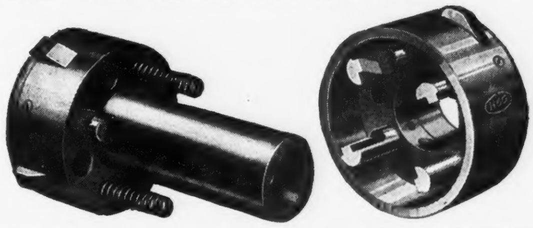

Style A, taken apart, showing the simple construction

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Carbon and High Speed Steel
ALL STYLES

THE STANDARD TOOL CO.

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W&B

The Whitman & Barnes Mfg. Co.
TWIST DRILLS & REAMERS
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NATIONAL TWIST DRILL & TOOL

WHAT do you get when you purchase ***twist drills, reamers, or milling cutters?***

If the ***National Twist Drill & Tool Co.'s Tools*** have been used on the job, you will find more work being produced and less tools being sharpened in your factory than ever before.

They are conscientiously built to withstand the hardest service ever encountered in production work and to maintain accuracy during their entire life—which is much longer than the average cutting tools.

They demand your utmost confidence in every day service.

Try them on your next job.

National Twist Drill & Tool Co.

DETROIT, U. S. A.

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NATIONAL TWIST DRILL & TOOL

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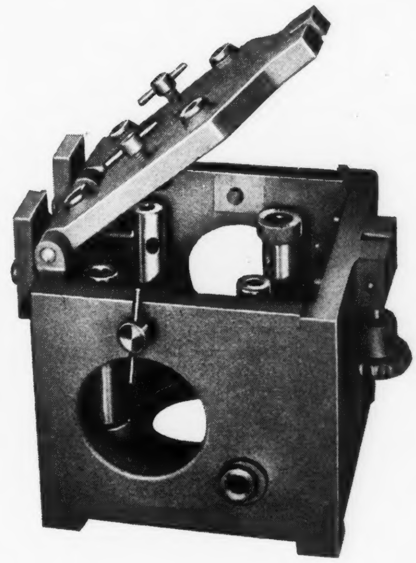
Bilton Reputation and Experience are Back of Bilton Contract Work



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BRIDGEPORT **CONNECTICUT, U. S. A.**

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Tool Engineers and Builders

DAYTON Carroll ENGINEERING SERVICE **OHIO, U. S. A.**

Special and Standard High Grade Machinery

Jigs, Tools, Fixtures, Punches and Dies

Send blue prints for estimates

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Send us your blue prints for estimate and time study.

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Dies, Tools, Jigs, Gages, Fixtures, Etc.

We have the reputation for producing tools that are fool-proof, easy to manipulate and give the largest possible production.

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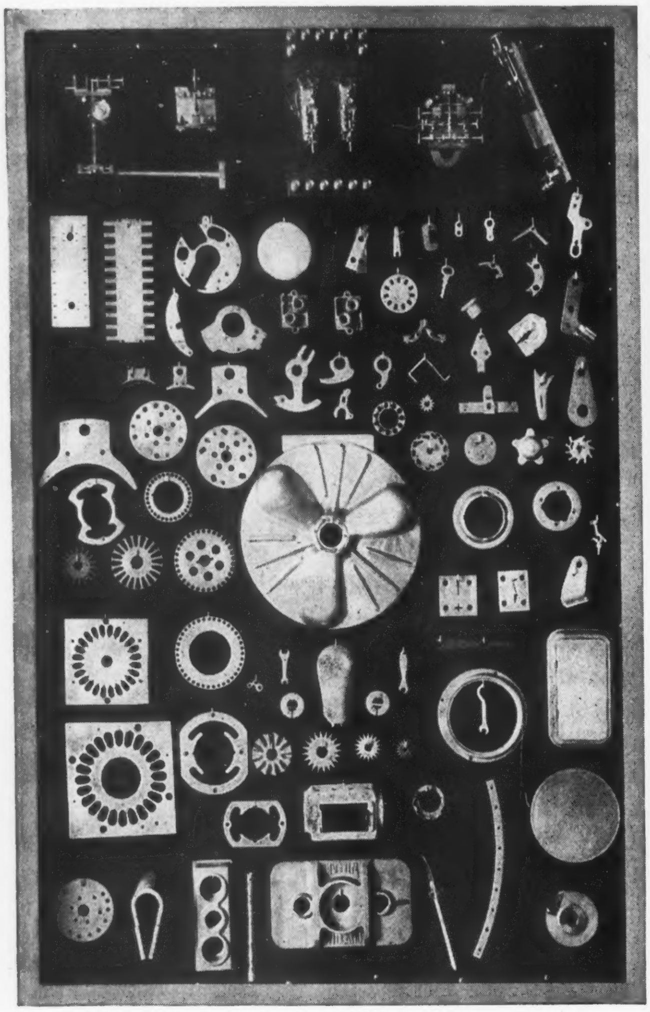
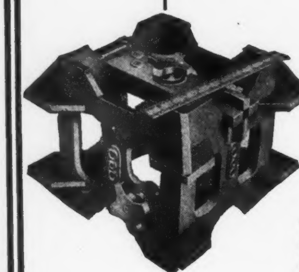
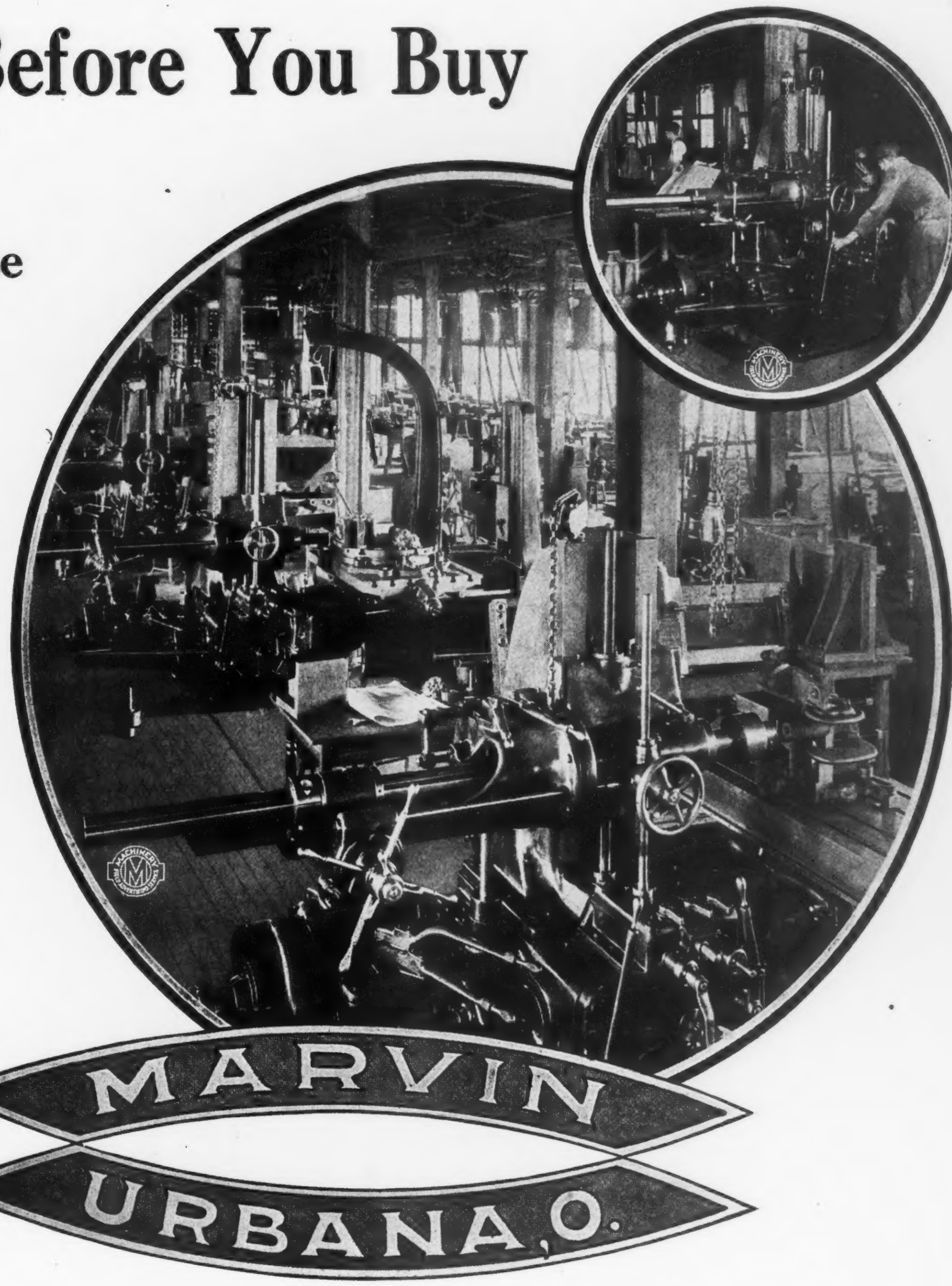
533 North 11th Street **Philadelphia, Pa., U. S. A.**





Look Before You Buy

A Glimpse of the Marvin Shops

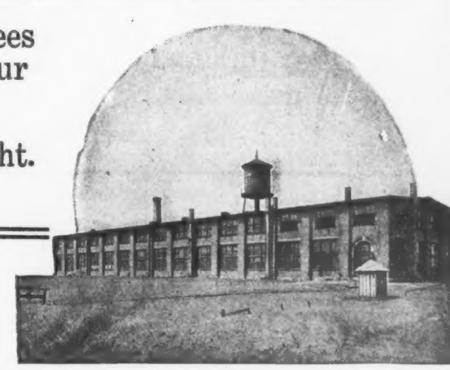


Placing contracts for special machines, tools, jigs, dies, etc., blindly is much like buying watermelons—you can't tell what you've got until the deed is done.

Reputation for past performance—of no use in the case of melons—is the one infallible sign that points the way for the man placing contract orders for new work.

The Marvin reputation for efficient service guarantees satisfaction to the manufacturer—you buy with your eyes wide open.

Old customers say—Marvin prices and results are right.



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IT PAYS TO MAKE GOOD TOOLS
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If you're on the market for Fixtures, Jigs, Dies, Gages, Special Machines and Machinery you'll find it of advantage to communicate with us.

THE GEM CITY MACHINE COMPANY

Manufacturing Machinists

DAYTON **OHIO, U. S. A.**

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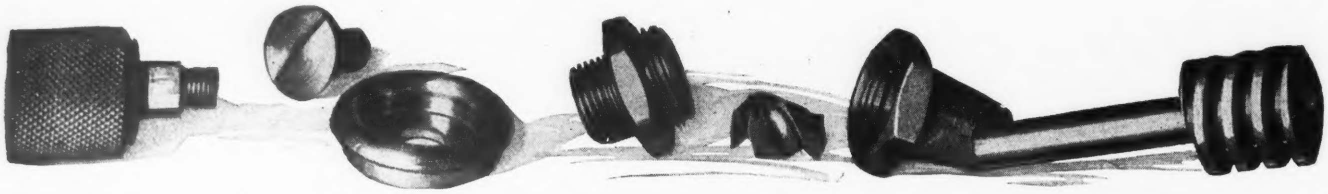


Let Contract Specialists Handle Your Contract Work

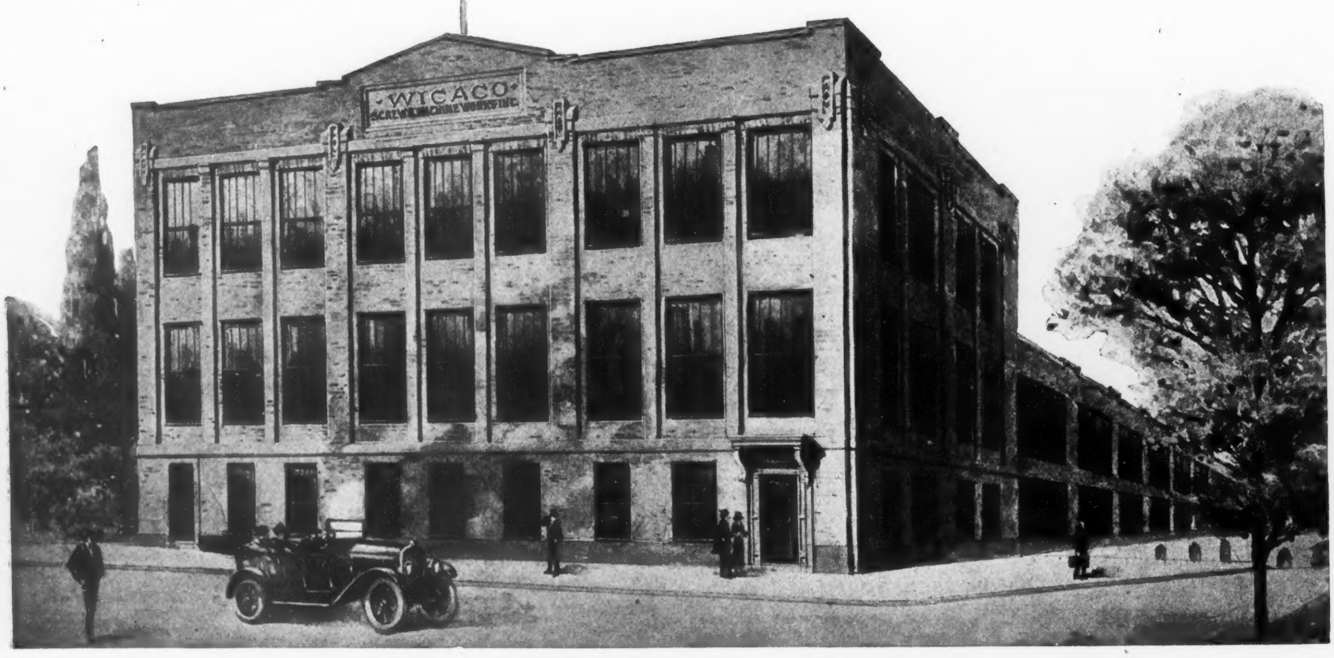
Let men who "know how" see that you get what you want at the proper price.

Wicaco Service is ready to supply you with anything you need in the way of contract metal work; complete and efficient, it insures economical production and satisfactory results.

We specialize on screw machine products, external and internal grinding, thread milling and the manufacture of machines, tools, cutters, jigs, fixtures, etc., in brass, bronze, monel, steel and iron.

Get a Wicaco estimate on your next contract job.

Established 1868



Wicaco Screw & Machine Works, Inc.

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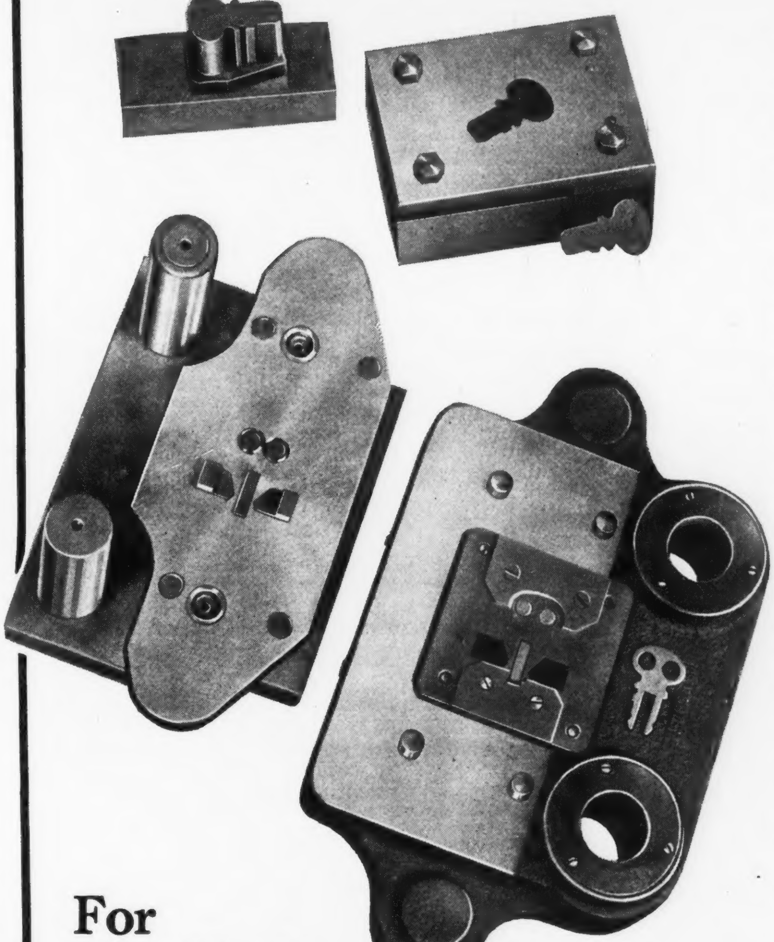


Here's What the Right Kind of Shaving Die Will Do

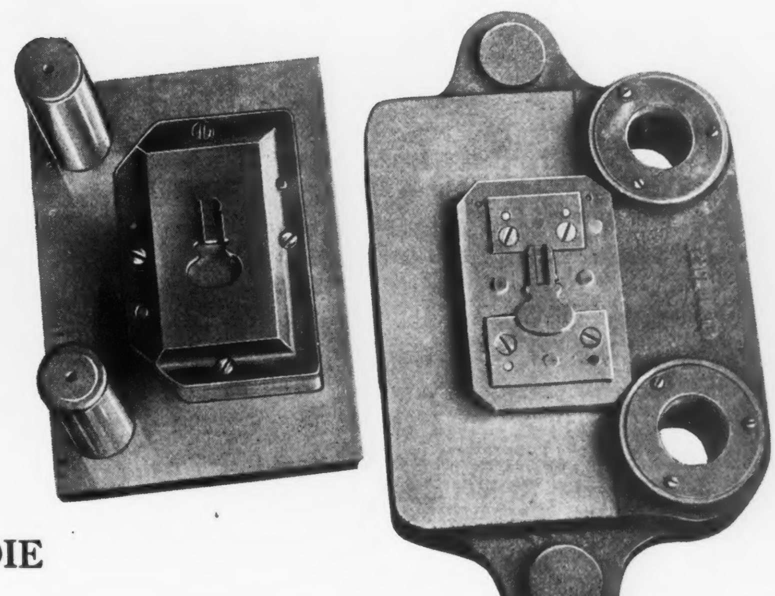
Study these photographs and you will appreciate that the exacting requirements the buyer dictated *were met*—100% right. The pictures represent a set of three dies for a cash register key: blanking die; notch and pierce; shaving die.

To secure the satisfactory shave, the fit between the punch and die *must be perfect*, neither tight nor loose. *The walls of the die must be straight to insure long life.* This Urbana product is all of these things. We build a great many shaving dies, and the service they are rendering speaks volumes for the quality of Urbana workmanship.

Shaving dies are used to secure smooth, square edges on stampings and to maintain extreme accuracy of outline. In these key dies, the edges of the key (throughout its working outline) are square, smooth and accurate to within one-half thousandth for some of the dimensions and one thousandth on others.

For Fine Tools Come to Urbana

Write us for particulars. We are specialists in jigs, fixtures and dies for a wide variety of effort including rifle, watch, adding machine, automobile and electrical work.



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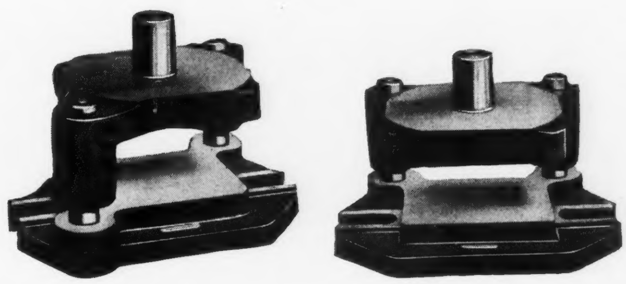

U. S. Sub Presses are made in large quantities; they are inexpensive because produced on a production basis. Though they cost much less than the average toolmaker could build them for, they lose nothing in quality on this account.

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Let us quote you on your Stampings, Dies, Jigs, Gages, Fixtures and Experimental Work.

U. S. TOOL COMPANY, Incorporated

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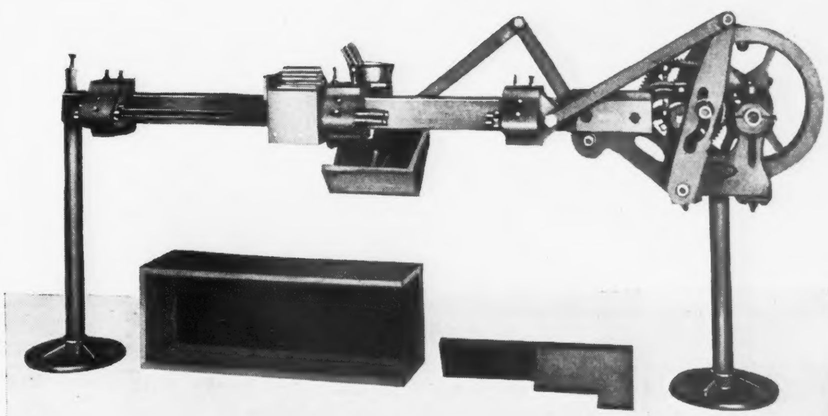

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Advertisements in this section, 25 cents a line, seven words to a line—minimum, $1.50. The money should be sent with the order. Answers addressed to our care will be forwarded. Original letters of recommendation should not be enclosed to unknown correspondents.

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ENGINEER with many years' experience designing Sheet Metal Machinery and varied equipment of dies as used most on the up and down power brakes or metal forming presses. The superintendent of a large sheet metal shop capable of the above work might fill the job. Answer Box 468, care MACHINERY, 148 Lafayette St., New York.

WANTED.—A WORKS MANAGER of A-1 ability, modern in his ideas concerning management of labor, and thoroughly up-to-date on all other questions relating to manufacture of metal products in a plant employing fifteen hundred to eighteen hundred in normal times. State experience, salary required and references. Only thoroughly experienced men need apply. Box 472, care MACHINERY, 148 Lafayette St., New York.

WANTED. — GEAR RESEARCH ENGINEER. Large automobile manufacturer requires the services of a Gear Research Engineer. College graduate with theoretical as well as practical experience. Also must be acquainted with all troubles that may arise on Front End Motor Gears as well as the cutting of the same. Splendid connection to right party. Address Box 474, care MACHINERY, 148 Lafayette St., New York.

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FACTORY EXECUTIVE.—Young man with two years' college education; eight years' practical experience as machinist and toolmaker; drafting, metallurgical chemical analysis, and capable of solving simple mechanical engineering problems, desires position. Box 476, care MACHINERY, 148 Lafayette St., New York.

WANTED.—AN OPPORTUNITY to enter a manufacturing business that needs new blood. An engineer with originality and willing to work, 40 years old, 18 years' experience in managerial and executive capacities. Familiar with organization and production methods. Practical experience in organization, equipment, and management of light manufacture. Address Box 470, care MACHINERY, 148 Lafayette St., New York.

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PATENTS SECURED. — C. L. PARKER, Ex-member Examining Corps, U. S. Patent Office. Instructions upon request. McGill Bldg., Washington, D. C.

PATENTS. — H. W. T. JENNER, patent attorney and mechanical expert, 622 F. St., Washington, D. C. Established 1883. I make an examination and report if a patent can be had, and the exact cost. Send for full information. Inventors assisted in developing ideas and inventions.

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CONTRACT WORK.—French machine tool manufacturers will manufacture on license American machine tools. Address: CUTTAT, 53 rue Servan, Paris.

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ADDING MACHINES.—The action is simple, rapid, exact and guaranteed perfect for 5 years. Eliminate errors and brain fag. Price $15.00. L. LEMON, 16 N. Hoyne Ave., Chicago.

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The undersigned provides a confidential service designed to locate openings through correspondence for men earning not less than $2,500 and up to $25,000; all lines. Not an employment agency, but a constructive, initiative service, covering individual negotiations. Established 1910. Complete privacy assured; present connections in no way jeopardized. Send name and address only for explanatory details. R. W. BIXBY, INC., 309 Lockwood Bldg., Buffalo, N. Y.

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WANTED.—10 ft. or 8 ft. power drop brake No. 10 iron. 10 ft. or 8 ft. power shear No. 10 iron, direct connected if possible. Box 475, care MACHINERY, 148 Lafayette St., New York.

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See the Green Section

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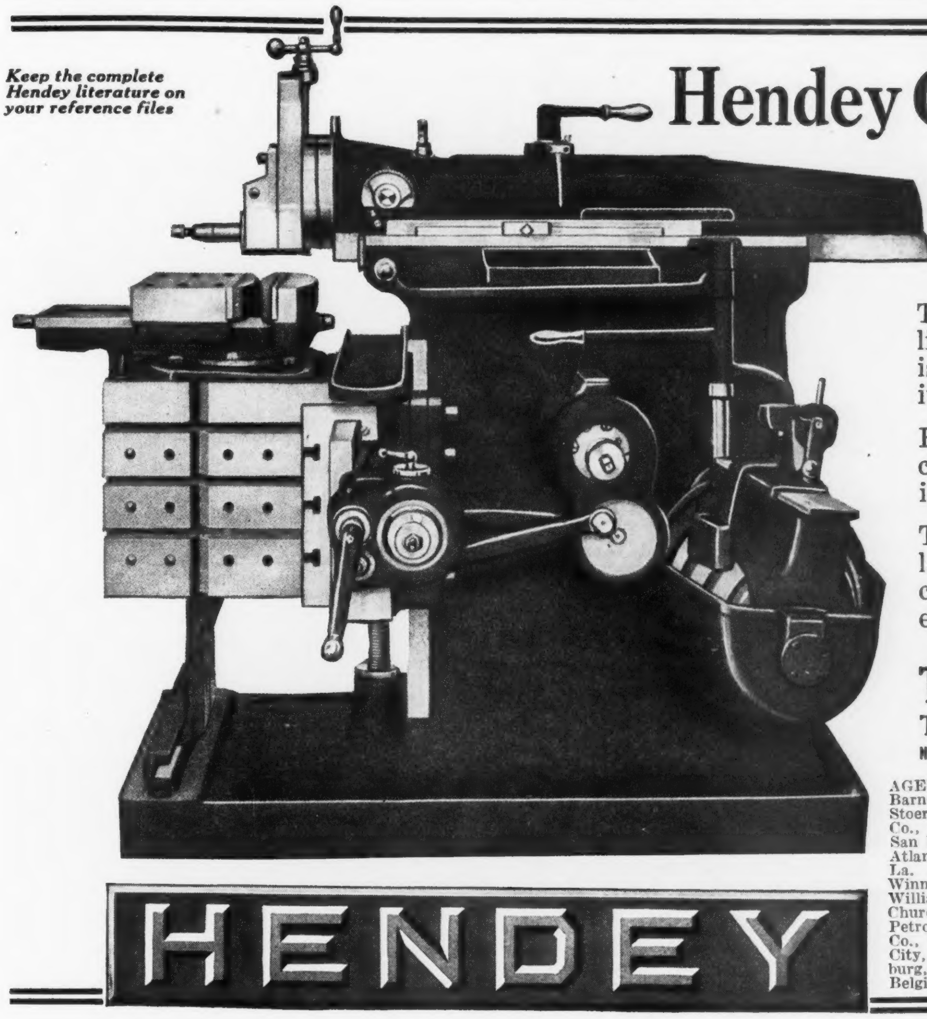

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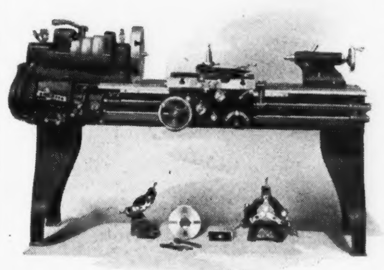

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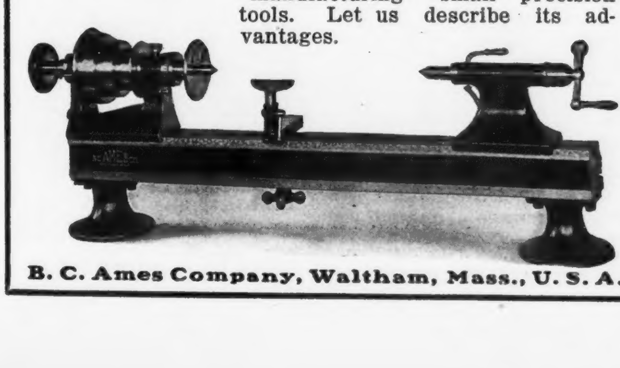

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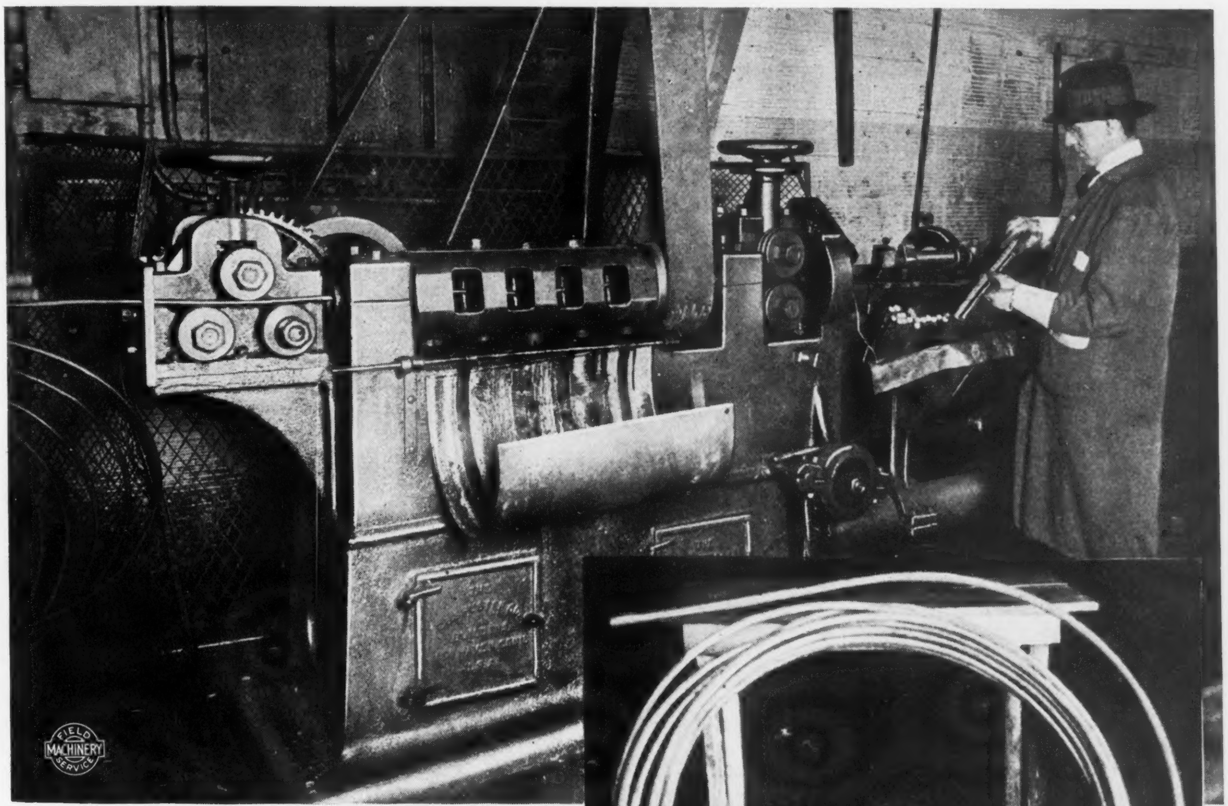

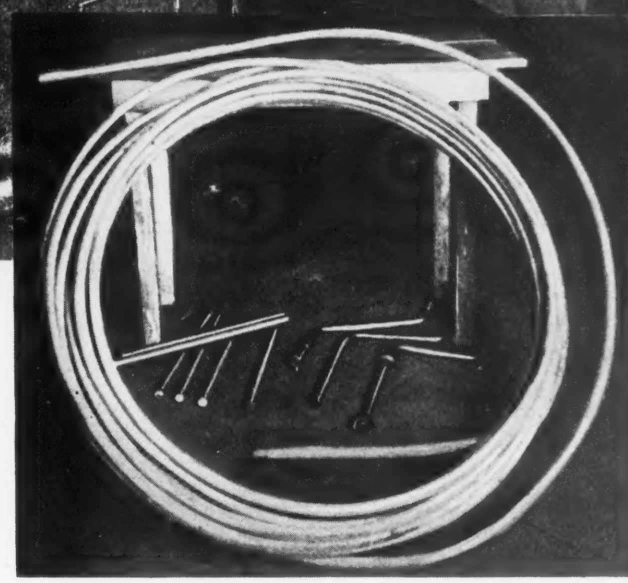

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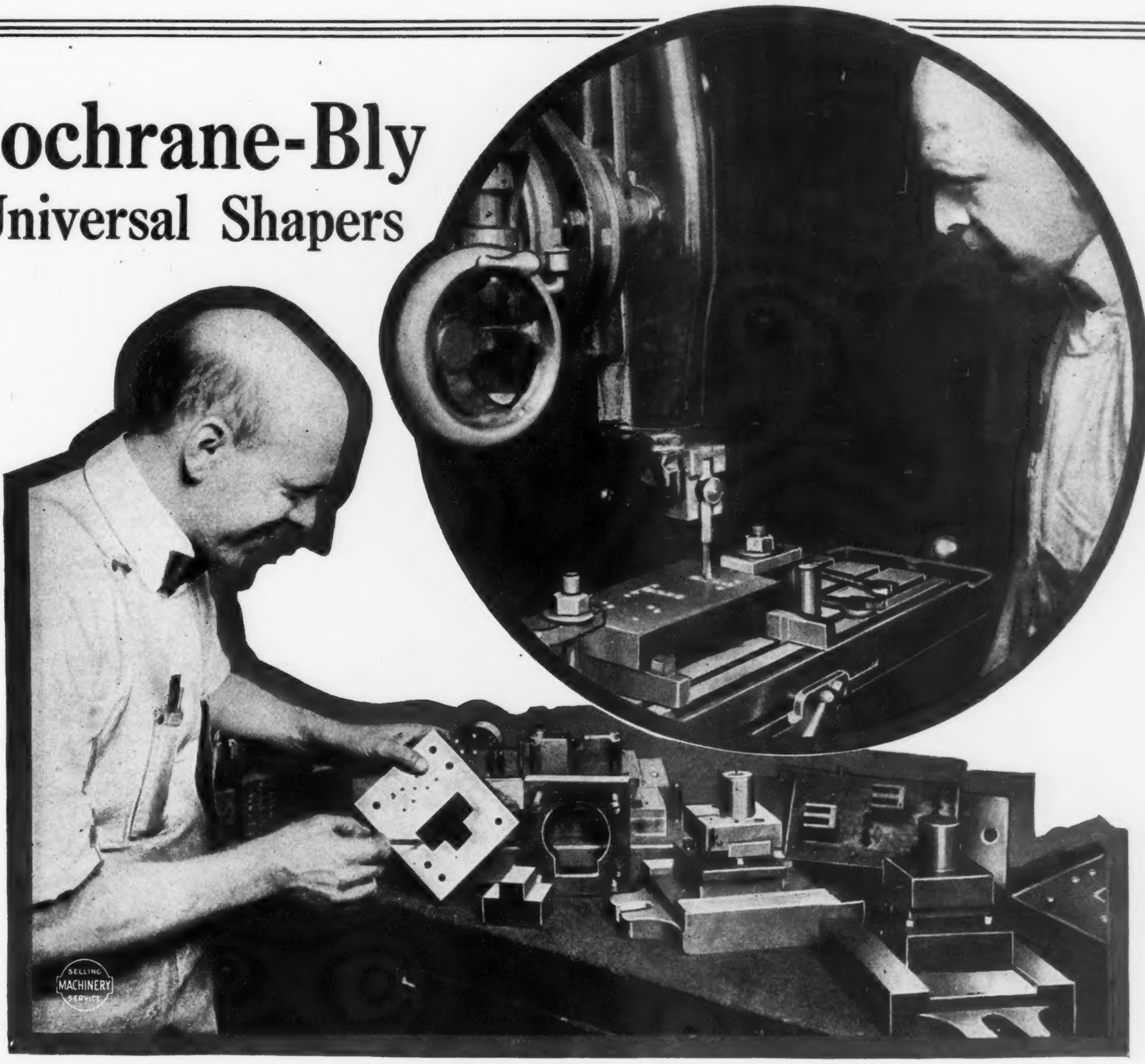

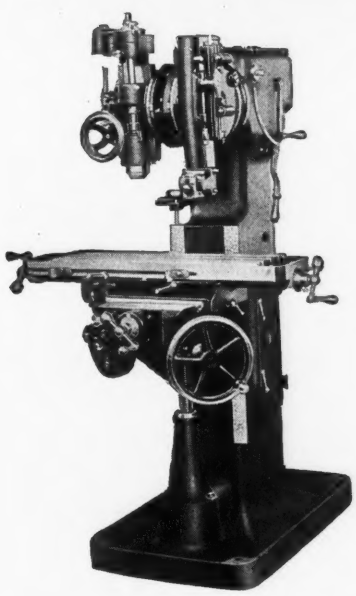

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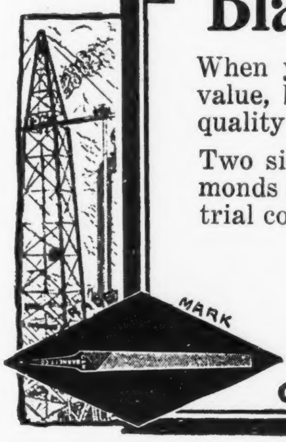

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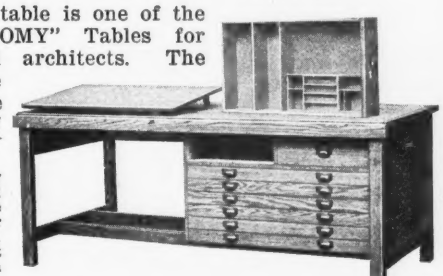

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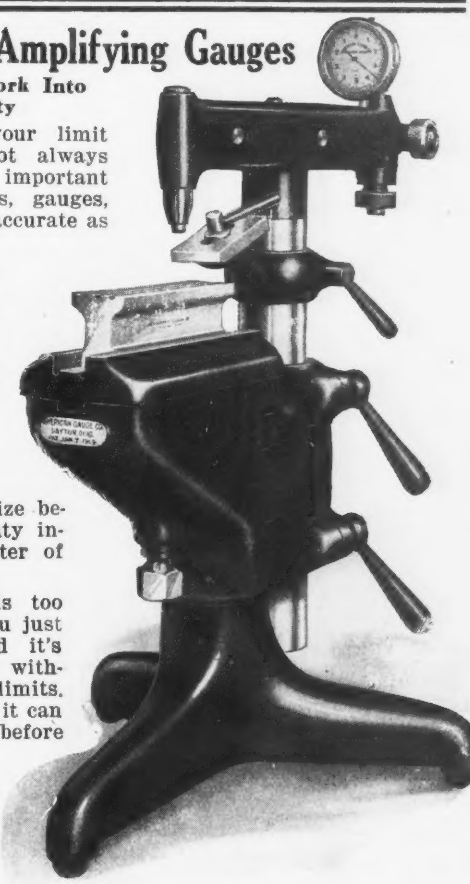

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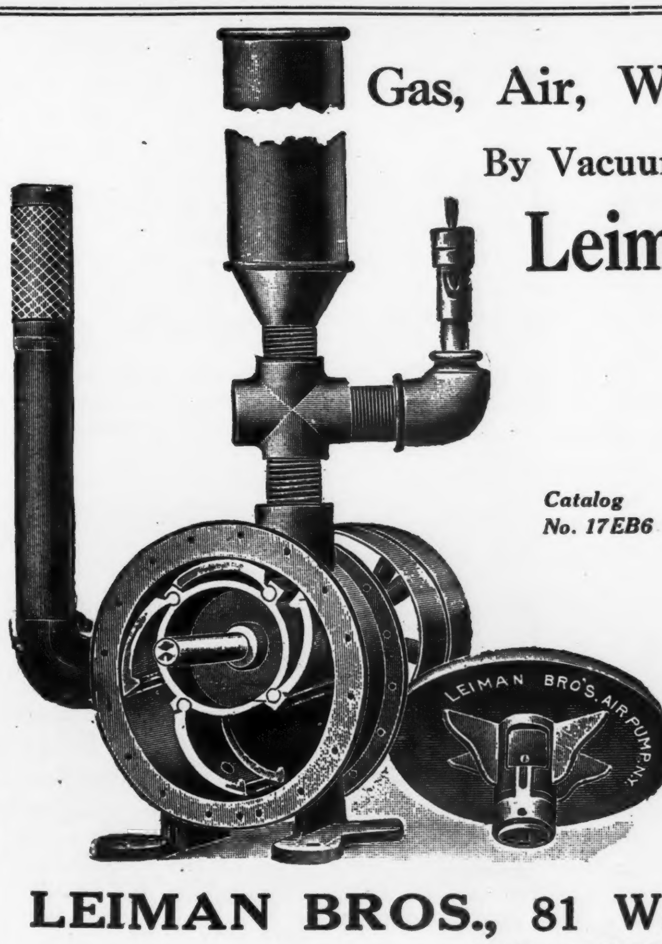

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Brown Engineering Co., 133 No. 3rd St., Reading, Pa.
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RACKS, TOOL
See Racks, Stocks, Tool and Pattern.

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Smith Tool & Mfg. Co., R. G., Newark, N. J.

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McCrosky Tool Co., Meadville, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
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See Lathes, Spinning.

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Philadelphia Gear Works, Philadelphia.
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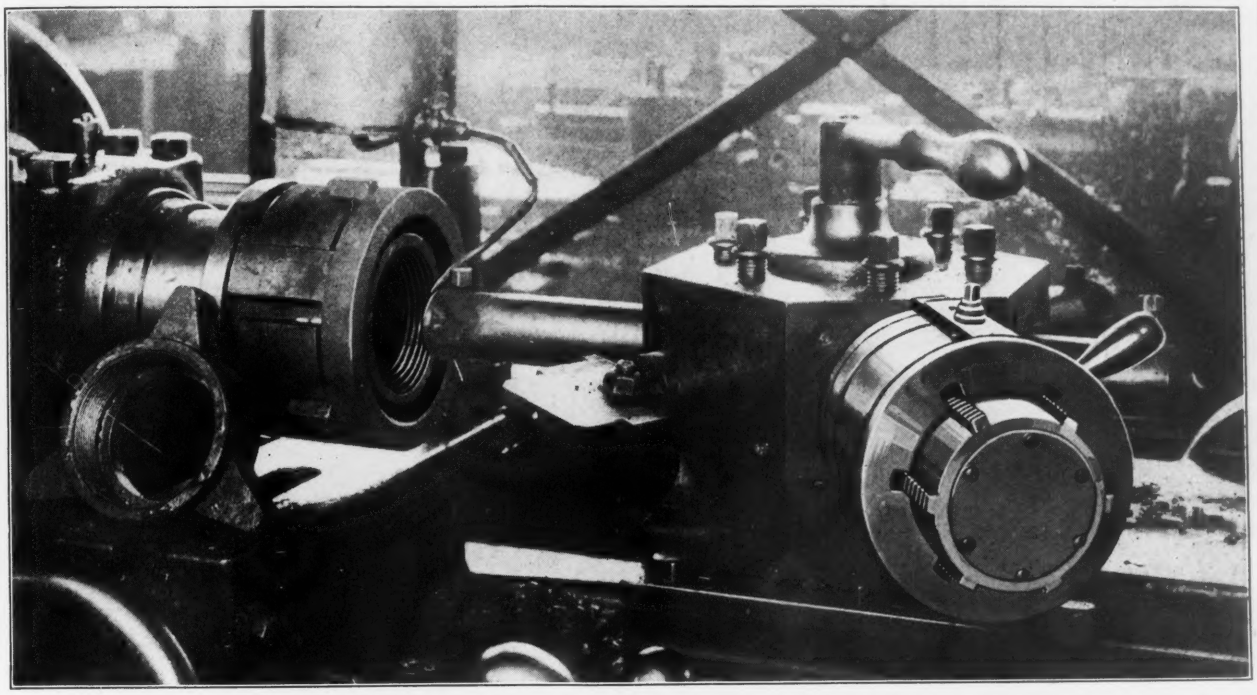

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